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DEPARTMENT OF DEFENSE APPROPRIATIONS FOR 1994

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PT. 5
Department of Defense Appropriation...

RINGS

.FORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS
HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

SUBCOMMITTEE ON THE DEPARTMENT OF DEFENSE

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DEPARTMENT OF DEFENSE APPROPRIATIONS FOR 1994

Wednesday, April 28, 1993.

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, ARMY

WITNESSES

LT. GEN. WILLIAM H. FORSTER, USA, MILITARY DEPUTY TO ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT, AND ACQUISITION

GEORGE T. SINGLEY III, DEPUTY ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY, OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT, AND ACQUISITION

MAJ. GEN. RONALD V. HITE, USA, DEPUTY FOR SYSTEMS MANAGEMENT, OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT, AND ACQUISITION

Introduction

Mr. Murtha. The Committee will come to order. This afternoon we will hold two separate hearings. The first will discuss the Army's Research, Development, Test and Evaluation programs. At approximately 2:30, we will recess for a few minutes and then hear the Acting Director of the Strategic Defense Initiative (SDI) Office on SDI programs. Both hearings will be held in executive session due to the classification of the material to be discussed.

We welcome Lieutenant General William H. Forster, the Military Deputy to the Assistant Secretary of the Army for Research, Development, and Acquisition; Mr. George T. Singley III, the Deputy Assistant Secretary of the Army for Technology; and Major General Ronald V. Hite, Deputy for Systems Management, Office of the Assistant Secretary of the Army for Research, Development, and Acquisition.

The total amount requested for RDT&E, Army in fiscal year 1994, is $5.3 billion, a decrease of over $700 million from last year's appropriation.

Gentlemen, welcome. Your prepared statement will be made a part of the record. Please summarize your statement at this time.

Summary Statement of General Forster

army's modernization vision

General Forster. Thank you very much.

I ask that my formal statement be placed in the record. I would like to talk about the Army's modernization vision, how we derived our budget from it and some of the tough choices we had to make in ramping down to the Fiscal Year 1994 budget before you.

If there are questions or if I am not clear about something, please interrupt.

There is no question that the world has changed and that the Army has changed with it. We do not consider our 1994 budget to be a place holder or a treading water budget. This budget continues the transition from a Cold War Army to America's Army, trained and ready to deploy whereever the American people send us.

It is a stand-alone issue.

In light of the changes in the world and the four dangers as outlined by Secretary of Defense, Mr. Aspin, we intend to continue to fight as a combined arms team that will be part of a joint team, including the Marines, Navy, Air Force and probably a coalition partners.

We have defined five capabilities that our Army must have to fulfill the missions expected of us. Let me list five modernization capabilities. We must project and sustain the force. The Army will be primarily CONUS-based as the dollars go down. We have to get to the fight and once there, we must sustain it.

We have to protect our force. We have always been sensitive to our soldiers, their health and our ability to avoid casualties.

We have to win the battlefield information war. This is a new construct for us. We used to call it C3I. We have to keep our commanders smart and give them the right information to act at the right time while, at the same time, we keep the enemy dumb. There can be a number of different ways of doing that, but that is the bottom line.

We have to conduct precision strikes throughout the battle or we used to think in terms of precision strikes deep, now we need to be able to do them laterally in support of the maneuver battle and deep at the same time in order to take out the enemy reinforcement capabilities.

Finally, you have to dominate the maneuver battle, win the close combat with tanks, artillery and infantry. We must destroy the enemy's Army, take his land and force him to try and come back and take it from us.

So those are the five capabilities that we have to have.

Let me explain some of the programs that are associated with each capability. I will talk to them in detail. First, projecting the force and sustaining it. We want to make our light forces more lethal and our heavy forces more deployable.

Systems like the Javelin anti-tank missile system are key here. It has been a successful R&D program, is scheduled to enter Initial Operational Test and Evaluation this fall and begin Low Rate Initial Production next year.

It is leap-ahead technology in a small package, much less weight than Dragon and its night sight, with twice the range and better night and adverse weather capability, man-portable and can be fired from enclosed bunkers. Javelin is a giant step forward for our light forces and their ability to engage tanks.

The Armored Gun System fits here. Light weight, air droppable, it provides a protected direct fire system for the lighter forces.

Comanche plays here because it is designed for the light forces. It is self-deployable. You can get it to Europe, the Middle East and Africa without using airlift. Once there, it provides capability for reconnaissance and attack that we have never had before and can be projected early and rapidly without a large infrastructure and sustainment tail.

In sustaining the force, we want to increase reliability and decrease the tail on everything we develop in the future. Our Palletized Load System is not an R&D program, but is very important because it saved us in truck drivers and mechanics alone, 2,800 spaces in our deployable forces that we don't have to put into support now.

Getting into protecting the force, first comes to mind Patriot, PAC-3, and its ability to engage tactical ballistic missiles.

We are upgrading the PAC-2 capability that we deployed to the desert and will increase its footprint substantially over what we have now with PAC-2. That is being worked with SDIO.

Medical research and development falls under protecting the force because we need to protect our troops from illness. That is a big area of research and development.

Winning the information war is key because we can get the biggest advantage for our smaller forces of the future by making sure that all commanders have a shared view of the battlefield. They will be able to better synchronize their forces, concentrating fire support, drop the shells and the tanks and maneuver forces that go with them at the right time.

A lot of this depends on accurate high-speed intelligence gathering systems and command and control systems, but it also depends on our ability to take out the enemy command and control system. Our longer-range Army Tactical Missile System is a key component in this area because it lets us strike deep at the enemy's command and control facilities.

For precision strike, one of our key elements is the Advanced Field Artillery System. It is in the concept development phase and will allow precision strikes throughout the battlefield as will the ATACMS and the Tri-Service Standoff Attack Missile with antitank, antiarmor submunitions on it.

Dominating the maneuver battle is where the tanks with the M1A2 upgrades, the Bradley fighting vehicles with its upgrade program starting in 1994 and the Longbow Apache come to the fore. All are key elements in our ability to dominate the maneuver battle. The Armored Gun System and lighter systems will do it for light forces as the M1A2 and the Bradleys will do it for the heavy forces.

UPGRADING EXISTING SYSTEMS

One way we expect to implement some of these things in a period of our significantly reduced R&D budget is by upgrading existing systems and not by buying new systems.

Winning the battlefield information war and dominating the maneuver battle are key areas where we intend to upgrade several systems as much in parallel as possible.

One thing we want to do here is to try to get compatible data modems on the Apache Longbow, on the Bradley and on the tank in sufficient time so that we can operate together. Here you would have an Apache Longbow or a Comanche that would see a picture of the battlefield and be able to transmit it directly to the tank or Bradley and back into the artillery fire support system so that every element of that team will know where the enemy is, who he is, and where the friendly forces are.

SYNCHRONIZE THE BATTLE

That lets us synchronize the battle so the commander can make sure that all forces are operating against the same enemy, by knowing where the friendly forces are. It will reduce the potential for friendly fire casualties.

We demonstrated this concept two weeks ago at Fort Knox. We had a Kiowa Warrior helicopter that scouted the battlefield out front in a simulated exercise, located targets and passed those targets directly to tanks and to Bradleys equipped with the intra-vehicular information system. The location of the targets showed up on the display screen and went into the artillery fire control system. Throughout the exercise, the location of the friendly forces showed up as a different icon in each maneuver unit so they were constantly updating the location of the friendly forces that were fighting together.

Everybody in that battle was able to see where the enemy targets were and knew where the enemy and friendly forces were. It showed great potential for speeding up the pace of battle and letting us build on technologies we have already. We will pursue that in all the upgrade programs as we move into the future.

FISCAL YEAR 1994 ACQUISITION PROGRAMS

I mentioned that fiscal year 1994 is not a place-holding budget for us. In adjusting the FY94 budget for the President's plans and getting it here, we took heavy hits on our R&D and procurement accounts. We tried to do those in such a way that it did not foreclose any options for us and yet it took realization of the tough times to come and stay within the purview of our modernization plan.

In other words, we did not take out any one of the five categories or hit one harder than the other. We kept a balanced program there. That was not easy to do because our procurement program is down 48 percent from what we planned on in fiscal year 1989.

The R&D account has held fairly steady, but is now beginning to show a downturn. One of the problems that we have in the research and development account is we have a lot of overhead and facilities. In preparing for the fiscal year 1994 budget, we looked at reducing overhead and preserving as many dollars as possible for R&D programs. We had to make tough decisions on facilities. For example, we elected to begin shutting down the high energy laser test facility at White Sands in 1994. There was $20 million overhead there and we did not see that we were going to get the benefits from that in the near term compared to other R&D efforts that we had going. Tough choices, but when all was said and done, we protected the Army priorities.

We are going to keep our primary programs of Comanche, Advanced Field Artillery System, Javelin, Armored Gun Systems, M1A2, Apache and Bradley upgrades, and the Command and Control Vehicle. If we focus on those systems, we will be able to maintain the technology advantages that we have demonstrated in the past and that we want to build on in the future.

We must continue to own the night, to strike freely with smart submunitions and with great precision. We want to have a shared view of the battlefield so we can get all forces in the battle at the same time where the commander feels they are needed, and we want to take out the enemy's eyes and ears.

That is a quick overview of how we got to where we are in our fiscal year 1994 budget submission.

Mr. Chairman, we will be pleased to answer any of your questions.

Mr. MURTHA. thank you, General.

[The statement and charts of General Forster follow:]

RECORD VERSION

STATEMENT BY

LIEUTENANT GENERAL WILLIAM H. FORSTER

MILITARY DEPUTY TO THE

ASSISTANT SECRETARY OF THE ARMY FOR

RESEARCH, DEVELOPMENT AND ACQUISITION

BEFORE THE

SUBCOMMITTEE ON DEFENSE

COMMITTEE ON APPROPRIATIONS

UNITED STATES HOUSE OF REPRESENTATIVES

FIRST SESSION, 103rd CONGRESS

UNITED STATES ARMY RDT&E, FISCAL YEAR 1994

28 APRIL 1993

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LIEUTENANT GENERAL WILLIAM H. FORSTER
MILITARY DEPUTY TO THE ASSISTANT SECRETARY OF THE ARMY
(RESEARCH, DEVELOPMENT AND ACQUISITION)

Lieutenant General William H. Forster, as Military Deputy to the Assistant Secretary of the Army for Research, Development and Acquisition, is the senior military advisor to the Army Acquisition Executive, the Army Chief of Staff and Vice Chief of Staff on all research, development and acquisition programs and related issues. He testifies as the principal military witness for Research, Development and Acquisition appropriations with the Congress, supervises the Program Executive Officer system, and serves as the Director, Army Acquisition Corps.

Lieutenant General Forster was born in Shelby, Mississippi, June 24, 1939. Upon completion of the Reserve Officer Training Corps curriculum and the educational course of study at the University of Alabama, he was commissioned a second lieutenant and awarded a Bachelor of Science degree in Chemistry. Delayed from active service while attending graduate school, he served with the 91st Division (USAR) until receiving a Doctorate of Philosophy (PhD) in Nuclear Chemistry from the University of California. His military education includes completion of the Air Defense Artillery Officer Basic and Advance Courses, the Armed Forces Staff College, the Navy Test Pilot School, and the Air War College.

Prior to assuming duties as the Military Deputy, Lieutenant General Forster served as Commander, United States Army Operational Test and Evaluation Command. Other key assignments include service as the Director of Requirements (Combat), Office of the Deputy Chief of Staff for Operations and Plans, HQDA; Program Executive Officer, Combat Aviation, St. Louis, Missouri; Program Manager for the Apache Advanced Attack Helicopter, U.S. Army Materiel Command; Project Manager for the Army Helicopter Improvement Program and subsequently, Deputy Commanding General, U.S. Army Aviation Systems Command, St. Louis, MO; and Chief of Aviation Systems, Weapons Systems Directorate, Office of the Deputy Chief of Staff for Research, Development and Acquisition, United States Army, Washington, D.C.

Lieutenant General Forster served in a variety of career building assignments preparatory to his most recent duties. He commanded the 10th Combat Aviation Battalion, and served as Deputy Director of the Army Space Program Office in Alexandria, Virginia. In addition, he served as a Force Integration Staff Officer in the Intelligence and Electronic Warfare Division, Requirements Directorate, Office of the Deputy Chief of Staff for Operations and Plans, United States Army in Washington, D.C. Earlier, he served two tours in the Republic of Vietnam, commanding both Aviation and Air Defense Artillery units. Lieutenant General Forster also served with NASA at the Johnson Space Center, Houston, Texas.

Lieutenant General Forster's awards and decorations include the Distinguished Service Medal, the Legion of Merit (with Oak Leaf Cluster), the Distinguished Flying Cross, the Bronze Star Medal (with Oak Leaf Cluster), the Meritorious Service Medal (with Oak Leaf Cluster), sixteen Air Medals, and the Army Commendation Medal. He also wears the Senior Aviator Badge, and received the Secretary of Defense Superior Management Award as Project Manager for the Army Helicopter Improvement Program.

He and his wife, Belle, have two children, William Jr. and Robert.

Mr. Chairman and Members of the Committee, thank you for the opportunity to appear before you to discuss the Fiscal Year 1994 (FY94) Research, Development, Test & Evaluation (RDT&E) budget request of the United States Army. It is an honor for me to represent the Army leadership, our Program Executive Officers (PEOs) and Program Managers (PMs), and the 30,000 civilian and military professionals of the Army acquisition work force. At the outset, I would like to thank you for the strong support you have given Army RDT&E and procurement programs in the past.

This year we again see the total budget for the Department of Defense (DoD) and the Army in decline. Our adjusted budget request for FY94 totals $60.7 billion, of which 20 percent is allocated for Research, Development and Acquisition (RDA), including our $5.2 billion request for RDT&E and our $6.8 billion request for procurement. Just three years ago, the Army projected its FY94 program at $98.3 billion and we were expecting $4.5 billion in RDT&E funding and $18.7 billion in procurement funding. The impact of reductions in our program has been significant. We have arrived at a delicate balance among size, readiness, and modernization.

Our Chief of Staff, General Gordon Sullivan, has stated that President Clinton's FY94 budget request will allow us to fulfill our obligations with "prudent risk." I agree wholeheartedly that reductions below President Clinton's proposed budget would severely limit our capability to do what is expected of us. Under this budget we will get significantly smaller, but we will maintain slow but steady modernization, while remaining fully trained and ready.

In these times of austerity, we remain committed to one enduring principle: the Army's ultimate purpose is to fight and win our nation's wars. Notwithstanding fewer resources, our smaller Army of the future must be more versatile and as capable as in the past. We realize that a large part of our success in the past has been derived from the successful application of America's technology. Our RDT&E budget for FY94, and our program for the outyears, strives to build on that success.

In many respects, the world today is more complex, uncertain, and volatile than during the Cold War. And from this, the check list of Army missions and responsibilities grows longer and includes the new challenges of worldwide disaster and humanitarian relief and peacekeeping operations. Secretary of Defense Aspin has outlined four dangers that we face post-Cold War. Our principal military concern in this era is the threat to stability in key regions throughout the world. We have seen aggression in Iraq; ethnic and religious civil wars in Bosnia; and anarchy in Somalia. None of these regional conflicts threaten our national survival, but they do threaten our national interests, our allies, and millions of our fellow human beings.

We must, therefore, be able to use our forces for peacekeeping and humanitarian missions, while maintaining without question our ability to reach trouble spots quickly and with overwhelming combat power in order to deter or defeat aggression.

The second danger to the international security environment is the proliferation of nuclear and other weapons of mass destruction. While we have long recognized the inherent dangers in the spread of these weapons and technologies, we are increasingly concerned about the growing number of countries that are developing or acquiring this capability. There exists no guarantee that countries will abide by nuclear arms control agreements. North Korea's decision to withdraw from the non-proliferation treaty is a prime example.

The third danger is the possible reversal of democratic reforms in Russia, Ukraine, and other nations that have formed as a result of the breakup of the Soviet Union. If these new democracies fail, hostile, authoritarian regimes may return along with prolonged internal violence and suffering. Democracy has spread around the globe, and we must work to ensure its success. An additional concern here is the transnational aspects of long suppressed ethnic, nationalist, and religious strife that can spread across present boundaries and further destabilize new democracies.

The fourth danger is the long-term threat that a weak

American economy poses to our security. President Clinton has stressed that America's economic strength is central to its security. Slow economic growth and a growing deficit threaten our economic strength. Security, which includes a quality Army, depends on growth and productivity in the private sector. Therefore, economic security is essential.

In this changing and truly uncertain world environment, a well-trained, smaller Army must maintain the overwhelming modernization advantage we have had to ensure land force dominance over potential adversaries. The smaller our Army becomes, the more modern and technologically overmatching it must be. Because people live on land, wars must be won on land. Land force dominance will always be required to deter or to win decisively, swiftly, with minimum casualties.

To achieve this land force dominance, the Army's modernization strategy places priority on five areas where the Army must maintain a decisive edge. These five modernization areas are:

- Project and Sustain the Force
- Protect the Force
- Win the Battlefield Information War
- Conduct Precision Strikes throughout the Extended Battlefield
- Dominate the Maneuver Battle

Let me explain each area and highlight the key development systems required to maintain our decisive edge.

Project and Sustain the Force. The capacity to deploy highly lethal forces rapidly on short notice is required for success in any modern operation. These forces demonstrate U.S. resolve, provide deterrence, protect critical ports and airfields, and provide the combat capability to ensure a decisive victory. We are rapidly becoming a Continental United States (CONUS) based Army with an ever more global mission. To be effective and credible, our CONUS-based Army must be able to project and sustain its forces anywhere in the world. The limiting factor to attaining this objective is air and sea lift. The Army supports the C-17 and Fast Sea Lift programs of its sister Services while working to make our forces more deployable.

The Armored Gun System (AGS), a highly deployable direct fire weapon, continues in Engineering and Manufacturing Development (EMD) in FY94. AGS will replace the M551A1 Sheridan and provide direct fire support to light forces when timely deployment of Abrams and Bradley equipped armored forces may not be feasible. The Improved Target Acquisition System (ITAS) for our TOW (Tube-Launched, Optically-Tracked, Wire Command-Link Guided) missile completed its Milestone II this past year and the Army recently awarded a contract for its continued development. ITAS will improve target acquisition and the engagement capability of the High Mobility Multipurpose Wheeled Vehicle (HMMWV) mounted TOW missile.

Javelin, which will complete development and begin (low-rate) limited production in 1994, is a man-portable, anti-tank system that will feature fire-and-forget technology and twice the target acquisition and engagement range of the Dragon missile it replaces. There is no comparable system fielded in the world today. Javelin's top attack capability and tandem warhead will defeat any known conventional or reactive armor.

Our forces, when deployed, must be fully supported. This support must be integrated with the combat forces and provide efficient distribution of critical materiel and supplies while minimizing air and sea lift requirements. Total Asset Visibility (TAV) will enable us to track Army assets throughout their life cycles. An operational prototype is being fielded to selected commands and installations, featuring visibility of 600 weapon systems and more than 210,000 end items, repair parts, munitions, and clothing items that support those weapon systems. This program will give the commander the information needed to direct critical resources to the right point on the battlefield, while ensuring only essential parts take up space on air and sea lift assets. Pending DoD approval, Army TAV capability will be fielded to additional sites during FY94.

Protect the Force. Our enemies will learn from Desert Storm and acquire modern technology and the skills to use it. Protecting U.S. forces has always been important to us, is critical now, and will be even more so in the future as our smaller force faces more devastating weapons. Air Defense is critical, particularly defense against theater ballistic missiles (TBMs). Even with the best Air Force in the world protecting us from air strikes, the Army still must protect airfields and its own forces from the terror of surface-to-surface missiles (SSMs) with chemical, biological, or large conventional warheads. As we observed in Desert Storm, missile defense will be required in any foreseeable contingency to protect critical airfields, ports, maneuver forces, and population centers. An effective counterfire capability is also required to destroy enemy TBM launchers before launch as well as counter artillery forces. As engagement ranges increase and we choose to fight more and more at night, combat identification through passive and non-passive means is essential to identify friend from foe in all conditions. Finally, we must retain the capability to operate in a chemical or biological warfare environment.

In FY94, we continue development of the PATRIOT Advanced Capability III (PAC-3) missile, communication upgrades, and target identification. PAC-3 represents the next evolutionary step in the development of PATRIOT, the world's only fielded, combat proven anti-tactical missile system. Under the joint Army and Strategic Defense Initiative Organization (SDIO) funded

Global Protection Against Limited Strikes (GPALS) concept, PATRIOT provides the lower layer of defense against TBMs, while the upper layer will be provided by the Theater High Altitude Area Defensa (THAAD)/Theater Missile Defense Ground-Based Radar (TMD-GBR), also in development. THAAD/TMD-GBR engages at high altitudes and long ranges to expand battlespace, and provides an overlay and cuing to the lower tier, PATRIOT and/or the projected Corps Surface-to-Air-Missile (CORPS SAM). Funding in FY94 continues Demonstration/Validation (DEM/VAL) and risk management programs of THAAD started last year. The GBR program will concentrate on designing and fabricating prototypes in FY94. In addition, Patriot Multimode and Extended Range Interceptor missile flight tests will continue. The Quick Response Program (QRP) consists of improvements to Patriot that will increase the defended area. These improvements include radar enhancements, remote launch, and emplacement enhancements. The Patriot QRP resulted in the fielding of one battalion this past year. This unit rotated to Saudi Arabia last March.

As a result of fratricide incidents during Desert Storm, the Army determined to develop initiatives that would minimize fratricide while maximizing combat effectiveness. The Battlefield Combat Identification System (BCIS) addresses a low cost, simple solution for near-term combat identification. This millimeter wave query/answer system is in source selection now and development will continue in FY94.

Win the Battlefield Information War. To win on the battlefield, the U.S. Army must, as part of a joint force, plan and conduct operations to destroy, disrupt, and control enemy information flow while ensuring our commanders get accurate information in time to use it. To win this battlefield information war, the Army must have the capability to gather information, process and transmit it around the battlefield quickly while denying any enemy the capability to do the same. We must digitize the battlefield to enable us to pass information on enemy and friendly locations rapidly among our combat forces. Digitization of the battlefield will enable us to maximize sharing of battlefield information for decision support and reporting purposes. Warfighters and command centers can be digitally linked to provide commanders and their staffs with a shared picture of the battlefield and combat crews with more effective situational awareness. Rigorous enforcement of standards will improve compatibility across systems and across Services, providing quantum improvements in real time command and control (C2).

In practical terms, this will allow the RAH-66 Comanche reconnaissance helicopter to share its sensors' view of the battlefield with artillery fire support elements and with M1A2 Abrams tank and upgraded Bradley Fighting Vehicle crews, allowing direct synchronization of fire and maneuver in real-time--speeding the tempo of the battle while minimizing both overkill and fratricide. All of this is possible through the use of digital systems and common data protocols incorporated into existing and developmental systems.

The Command and Control Vehicle (C2V) will provide a fully tracked, armored vehicle that will ensure a mobile, responsive, and survivable command and control capability for armored forces. The C2V will be capable of command and control while on the move and incorporate current and future command and control and digital systems from the Army Tactical Command and Control System (ATCCS) that are either under development or will be developed during its lifetime.

Research and development continues on the Army Tactical Command and Control System (ATCCS) hardware and software. This system provides improved communications and interoperability among five battlefield functional areas from the corps level to the soldier's foxhole. These systems include the Maneuver Control System (MCS), Advanced Field Artillery Tactical Data System (AFATDS), All Source Analysis System (ASAS), Forward Area Air Defense Command and Control Intelligence (FAADC2I) and the Combat Service Support Control System (CSSCS). ATCCS will serve as a combat force multiplier and permit the commander to control resources and communicate in a hostile electronic countermeasure environment more effectively. Current problems with the ATCCS program are attributed primarily to schedule slips due to the inability of contractors to deliver software within schedule, compounded by inconsistent funding profiles. To resolve these problems, the Army is restructuring MCS and ASAS to use the information technologies available from the commercial market as well as from government-sponsored R&D. Government R&D efforts are focusing on areas not addressed by the private sector.

The MILSTAR program is one of our most critical C2 programs. Without MILSTAR or a similar capability, the ability to respond and coordinate horizontally and vertically to prosecute warfighting missions at corps and division levels will be significantly constrained. Space communications is a cornerstone of the Army's force projection Command, Control, Communications, Computer, and Intelligence (C4I) strategy for the warrior.

Tactical reconnaissance and battlefield coordination will be enhanced significantly by the rapidly deployable RAH-66 Comanche helicopter, currently in the DEM/VAL phase. Not only is it deployable in cargo aircraft as small as the C-130, it has a self-deployment range of 1,260 nautical miles, sufficient to self-deploy from CONUS to Europe, Africa, and the Middle East. Although the Comanche program was started during the Cold War, its capabilities are relevant to regional conflicts. For example, actual experience in Just Cause and Desert Storm highlight the importance of improved deployability, night/adverse weather reconnaissance and target acquisition, deep reconnaissance without detection, better precision strikes both close and deep, and survivability as good as we can make it. The Comanche will replace two different helicopters and be more reliable and easier to maintain than any helicopter in the world. Therefore, we can reduce support troops and the amount of spare parts to be shipped forward. Comanche is now fully funded through EMD and into production.

Additionally, sensors that locate and identify targets (Joint STARS), intelligence fusion systems (ASAS), and long-range "smart" weapons (TSSAM and ATACMS) which deny the enemy the capability to locate and attack U.S. forces are essential for decisive operations. Timely and accurate information delivered over great distances and the means to capitalize on it immediately are absolutely critical to our smaller, force projection Army.

Conduct Precision Strikes throughout the Battlefield. To conduct synchronized, decisive operations, the Army must strike and destroy enemy forces throughout the battlefield; laterally, in close, and well forward of friendly forces. To do this responsively the Army must have modern artillery, attack helicopters, and missile systems with the requisite range and munitions. The munitions suite must include munitions that defeat moving vehicles as well as munitions to destroy high priority, short dwell targets such as tactical missile launchers and enemy air defenses. Against moving enemy maneuver formations, the Army must concentrate and coordinate indirect fires along with massed helicopter attacks. Clearly long-range sensors such as Joint Surveillance and Target Attack Radar System

(Joint STARS) and its ground stations and effective target development and distribution systems are essential. The Joint STARS Ground Station Module completes its testing this year and we plan to begin initial production.

The RAH-66 Comanche helicopter is key to meeting the future, worldwide light attack helicopter requirements for our light forces, as well as serving as a reconnaissance helicopter as previously discussed. The Comanche development program continues, including the T-800 engine upgrade and incorporation of the Longbow system. It is widely recognized as a model acquisition program. The Longbow fire control radar and fire-and-forget missile are being developed for integration into the Apache attack helicopter and the Comanche as it begins low rate production. This air/ground targeting radar is capable of being used day or night in adverse weather and with battlefield obscurants. Coupled with the stealth of Comanche it provides a survivable, pilot controlled capability throughout the depth and breadth of the battlefield--finding and engaging targets in support of light forces, finding targets for other systems, keeping the commander informed with advanced sensor data, and engaging targets with its Hellfire missiles when required for all forces.

The Tri-Service Standoff Attack Missile (TSSAM) EMD continues in FY94. Ground launched from the Multiple Launch Rocket System (MLRS) also, the Army variant of this autonomously guided tactical cruise missile carries Brilliant Anti-Armor Submunitions (BAT), also in EMD, beyond a 100 nautical mile range for both deep attacks in the enemy rear and lateral attacks in support of adjacent units. The ability to place precision guided munitions such as BAT on targets laterally and at depth while simultaneously fighting the maneuver battle is critical to success on the modern battlefield. This past year the TSSAM program experienced five successful test shots. The extended range MLRS rocket variant entered development with a contract award last year.

The Advanced Field Artillery System (AFAS) remains our priority fire support and armored vehicle of the future. The AFAS, with its regenerative liquid propellant gun, will provide leap ahead capabilities in range and rate of fire, as well as reductions in manpower and logistics burdens. Along with Comanche, it is a new development of an overmatching capability that also saves manpower. The AFAS is also the driver for advanced armor vehicles and much or its capability will be used in follow-on vehicles.

Dominate the Maneuver Battle. Decisive operations culminate with the destruction of the enemy's land combat capability. The Army must maintain an overmatching capability in maneuver forces for here the battle is decisive and the risk to our soldiers is highest. Real-time, combat information and intelligence must be available to maneuver task force commanders. The display of enemy information and friendly locations from digital sensors and data systems facilitates decisive maneuver and greatly reduces fratricide. We must use our advantage in speed and agility to win the direct fire battle with minimum casualties.

The Longbow fire control radar is being developed for integration into the Apache heavy attack helicopter, and later into the Comanche. The systems central processor will classify targets, establish priorities, and pass the target information to the Longbow Hellfire (radar frequency) missile. The pilot may then engage targets with significantly reduced decision and exposure times. Thus, Longbow increases the rate of Apache engagements while increasing its survivability. Longbow Apaches can also transmit radar and electronic pictures of the battlefield to upgraded Bradleys and Abrams. The Bradley upgrade program was initiated this year to modernize existing vehicles by increasing their survivability and enhancing their lethality, and an R&D program is underway aimed at providing them a digital capability. Upon completion of initial testing, the Abrams upgrade program was approved last year by the Office of the Secretary of Defense (OSD). Upgrades to the Abrams tank include position navigation equipment, a commander's independent thermal viewer, and a distributed power and data architecture. The Improved Recovery Vehicle, designed specifically for towing the Abrams tank, began its testing last year and will continue in FY94.

These are the five areas of our modernization vision and how representative major programs fit that vision. Now, let me discuss some general areas of the RDT&E request. We place continued, high priority on science and technology (S&T) efforts. This is the way to extend our current technological edge into the future. The core of our S&T strategy is to achieve early and continued user involvement; stress extensive and realistic technology demonstrations; exploit the explosion in advanced distributed simulation and information technologies; strengthen laboratory quality; aggressively support Project Reliance to curtail duplication of S&T programs; continue to expand our dual-use technology initiatives; and ultimately, provide the soldier the world's best fielded technology for decisive victory with minimal casualties.

The seven thrusts of the Defense S&T Strategy that help focus our efforts are: (1) global surveillance and communications; (2) precision strike; (3) air superiority and defense; (4) sea control and undersea superiority; (5) advanced land combat; (6) synthetic environments; and (7) technology for affordability. The Army's five modernization objectives are closely aligned with these seven S&T thrusts. Although we are vitally interested in all seven, we are DoD leaders for the Joint Precision Strike Demonstration (JPSD) and the Advanced Land Combat Thrust.

The objective of JPSD is to develop and demonstrate a system-of-systems concept which integrates surveillance, target acquisition, C4, precision weapons delivery and damage assessment functions for rapid execution in minutes, not hours, against high value, time-sensitive targets in adverse weather, day or night, at extended ranges. The JPSD program will enhance current Army Precision Strike capabilities by leveraging advanced technologies, new concepts, and architectures through an evolutionary series of demonstrations which include live firings and simulation. The FY94 demonstration will emphasize Army surface-to-surface weapon systems to include the live firing of a product improved Army Tactical Missile System (ATACMS). Beyond FY94, the JPSD program will conduct a Rotorcraft Demonstration focusing on the contribution of long-range Army Aviation and a Low-Intensity Conflict Demonstration incorporating Special Operations Forces (SOF). These demonstrations will culminate in an integrated Precision Strike demonstration with Air Force, Navy, and Advanced Research Projects Agency (ARPA) participation.

Under the Advanced Land Combat thrust, we will examine the potential of advanced technologies to improve our capability to project power from a CONUS base in response to regional conflicts. The thrust consists of three main S&T programs. In Advanced Vehicle Technologies, we are searching for ways to reduce the size and weight of combat vehicles, thereby making them more deployable and agile. In the Rapid Force Projection Initiative, we will examine a combination of new technologies and tactics for early-deploying, light forces to defeat enemy heavy armor without compromising their rapid, air deployability. The final component, 21st Century Land Warrior, will improve the survivability and flexibility of dismounted soldiers and Marines by capitalizing on the potential of a light weight data network for the soldier. We have strong user support from within the Army and the Marine Corps, and we are emphasizing jointness to the maximum extent possible. Advanced Land Combat provides options to lighten the heavy, strengthen the light, and modernize the dismounted. Our S&T vision, strategy, objectives, and funded plans are published annually in the Army S&T Master Plan.

We also need to capitalize on integrated process/product development. Continuous prototyping and development of manufacturing technologies will help us make advanced technology and weapon systems affordable. Under this approach we prototype new systems and components, then "rollover" the technology into new research programs, rather than seek to put each into production. In order for a new system to enter production, it would have to meet three strict criteria: (1) the system with its new technology works in the hands of soldiers; (2) the threat requires the system; and (3) the system is of such value it can impact battlefield operations by itself.

A good example of this strategy is the Army's Line-of-Sight Antitank (LOSAT) program, now in DEM/VAL. LOSAT will provide high velocity, kinetic energy antitank fire that cannot be countered by practical means. LOSAT fires will fix and destroy enemy armor, providing our tanks and infantry the freedom to maneuver into the enemy's vulnerable flanks and rear. LOSAT is building upon the earlier Joint Service Hypervelocity Missile Demonstration approved in August 1988.

These technology initiatives are not free, and as we strive to maintain, at best, level funding in our research and development program, we seek to reduce the cost of infrastructure to generate additional funding for technology. Therefore, the Army's S&T base is undergoing significant downsizing and restructuring. The Army Research Laboratory (ARL), a recommendation of the Army's LAB 21 study, was established last October consistent with Base Realignment and Closure (BRAC) 91. The ARL is the Army's "flagship" laboratory and will include two state-of-the-art research facilities--a microelectronics applied research facility at Adelphi, Maryland, and a materials research facility at Aberdeen Proving Ground, Maryland--to support the corporate laboratory.

Also part of BRAC 91, the number of Medical Research and Development Command (MRDC) research laboratories will be reduced from nine to six. The Army BRAC 91 consolidations and realignments, with an estimated savings of $191.9 million for ARL and $54.5 million for MRDC, will be completed in FY97.

The MRDC realignments were guided by the Tri-Service Project Reliance process. Project Reliance is one of the most comprehensive restructuring efforts of the DoD S&T base in recent history. This project, initiated in October 1989, has strengthened inter-Service cooperation in RDT&E programs and use of facilities by moving from primarily a coordination effort to higher levels of interaction through joint efforts, collocation and/or consolidation of research efforts. The Army initiatives to downsize our S&T infrastructure while providing world class technology have been guided by the Army Lab 21 study and the recent Army Science Board (ASB) study of the Army Materiel Command (AMC) Research, Development and Engineering Centers (RDECs). These initiatives are helping to focus and strengthen the Army's ability to execute its research and development (R&D) plans despite reductions in personnel and funding resources. We must execute their recommendations to ensure that the Army moves resources to the needed technologies to address 21st century challenges.

We must also change our approach to production and to the management of fielded systems. Our modernization objectives reflect the Army's intent to provide supportable, effective systems for a balanced, total force capability. We intend to achieve these objectives by allocating scarce resources to improve fielded capabilities with cost effective modifications, to integrate advanced technology into fielded and in production systems to leverage near-term and future combat capabilities, and to acquire new equipment through development programs only when it provides high pay-off, "silver bullet" capabilities. We must continue to provide warfighting capabilities that leverage commercial and other service technology and integrate that technology into our systems, both new and fielded.

The way to capitalize most efficiently on new technology is through Horizontal Technology Integration (HTI). HTI is the simultaneous integration of complementary technology into families of systems that must fight and operate together on the battlefield. For example, we would insert technologies such as combat identification devices and advanced sensors into all elements--tanks, attack helicopters, artillery--that make up our combined arms task forces within a division. We would upgrade all relevant equipment in a division before proceeding to upgrade another division--thus an upgraded M1A2 Abrams would fight with upgraded Bradleys and Longbow Apaches. By having these complementary technological capabilities (seeing the same enemy and friendly forces) in every combat system in a unit gives that unit a much greater capability than upgrading all tanks first, then all helicopters, and so on.

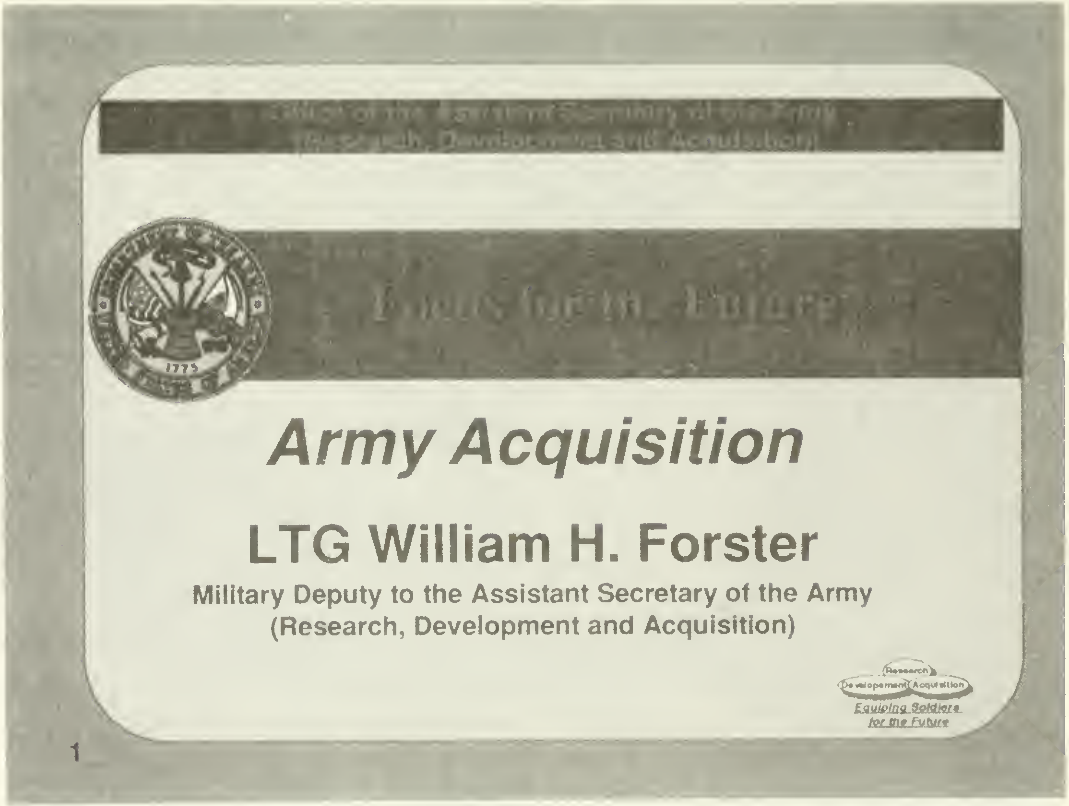
We are also spending more effort "up-front" to identify high pay-off opportunities and to determine how to incorporate new technologies and weapons developments into new organizations and doctrine to get the best pay-off. The Army is posturing itself to examine these issues through much more extensive and realistic modeling and simulation. Our Training and Doctrine Command has established several battle laboratories (Battle Labs) to focus on different battlefield dynamics leading to better requirements and better understandings of how different weapons can fight together. We are implementing the Louisiana Maneuvers (LAM) to link modeling and simulation with field exercises to achieve maximum value in training and in understanding the elements of doctrine, organization, and equipment that must be improved in the future. This will be accomplished using the Defense Simulation Internet (DSI) initiative with our Battle Labs and exercises.

Our overall strategy of technological superiority must mobilize to the fullest extent government, industry, and academic resources. The conversion of industry segments from defense needs to commercial products will reduce the R&D devoted to defense and also reduce the opportunity to transition S&T products to equipment in production and into the field. Because of declining budgets, the military will account for an ever smaller percentage of the market. Thus, the commercial market will likely become less responsive to military demands for unique standards and technologies. If the United States is to deploy and maintain military forces with overmatching technological superiority, then DoD will have to make ever more efficient use of available commercial technology, such as technology being developed for advanced aircraft and electronics. We totally support the Administration's emphasis on dual-use technologies, with their potential application in the civilian economy as well as in military systems.

The success of the Army's "Big Five" programs that were started in the 1970's--Abrams, Bradley, Apache, Black Hawk, Patriot--is unquestioned by our adversaries; but it took our Nation nearly two decades of hard work and ample funding to produce those systems and today's fully equipped, trained, and ready Army. As our resources decline, it is vitally important that we make the best possible use of every dollar to maintain this posture and improve it where possible. Our FY94 budget request contains the minimum funds required to do that.

Modernization is the key to tomorrow's readiness. It is imperative that we sustain modernization or our technological advantage over potential adversaries will diminish over time--increasing the risks to our soldiers. With fiscal realities in mind, we must carefully construct our modernization program around the capabilities that have been proven in combat, executing only a very few new development programs of highest priority. With your continued support, we will maintain this balanced program, improving the synergy of our systems and providing our soldiers what is needed to win decisively with minimum casualties.

Thank you.



Office of the Assistant Secretary of the Army
(Research, Development and Acquisition)

Focus for the Future

Army Acquisition

LTG William H. Forster

Military Deputy to the Assistant Secretary of the Army
(Research, Development and Acquisition)

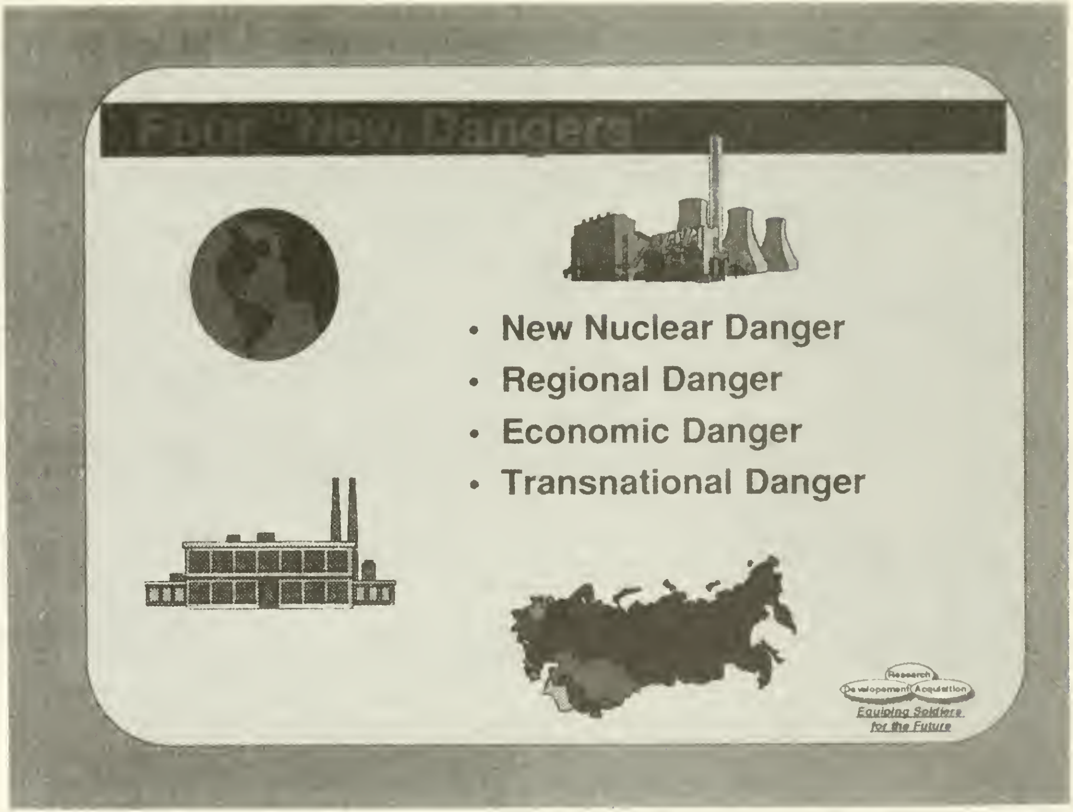
Research
Development
Acquisition
Equipping Soldiers for the Future

NEW SECURITY ENVIRONMENT

THE WORLD IS MORE:

- UNPREDICTABLE
- UNSTABLE
- VOLATILE
- LETHAL

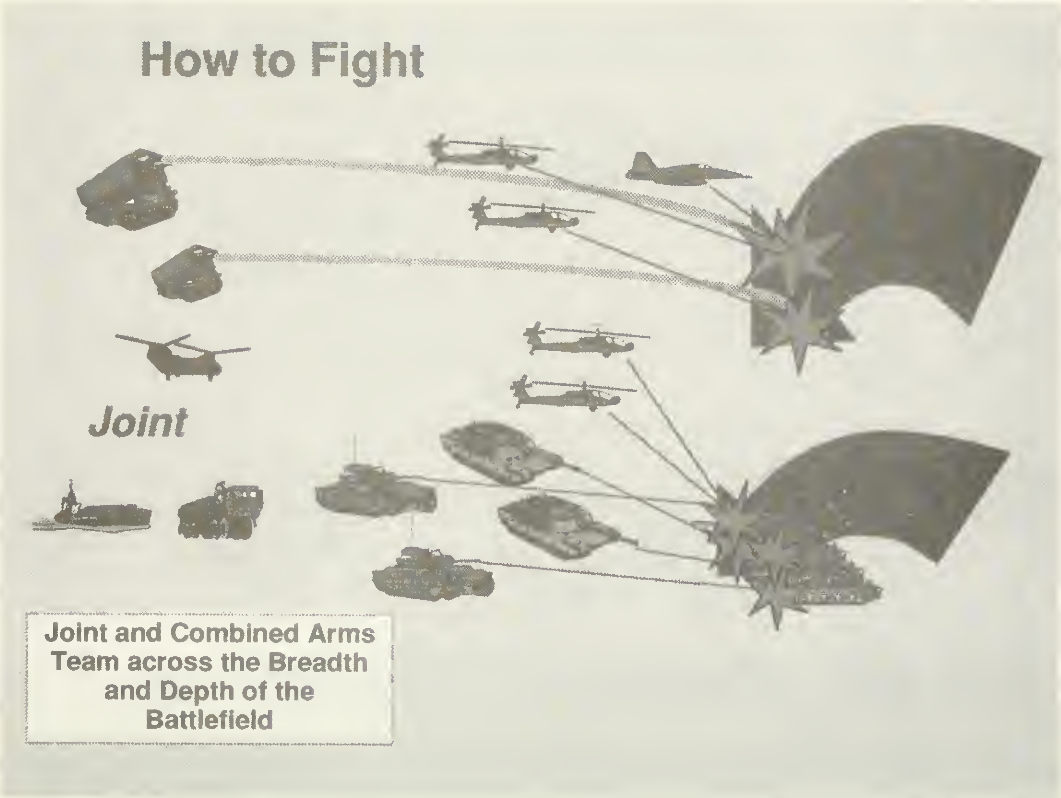
MODERN TECHNOLOGY READILY AVAILABLE TO ALL NATIONS - - THERE IS A WORLD MARKETPLACE



Four "New Dangers"

- New Nuclear Danger
- Regional Danger
- Economic Danger
- Transnational Danger

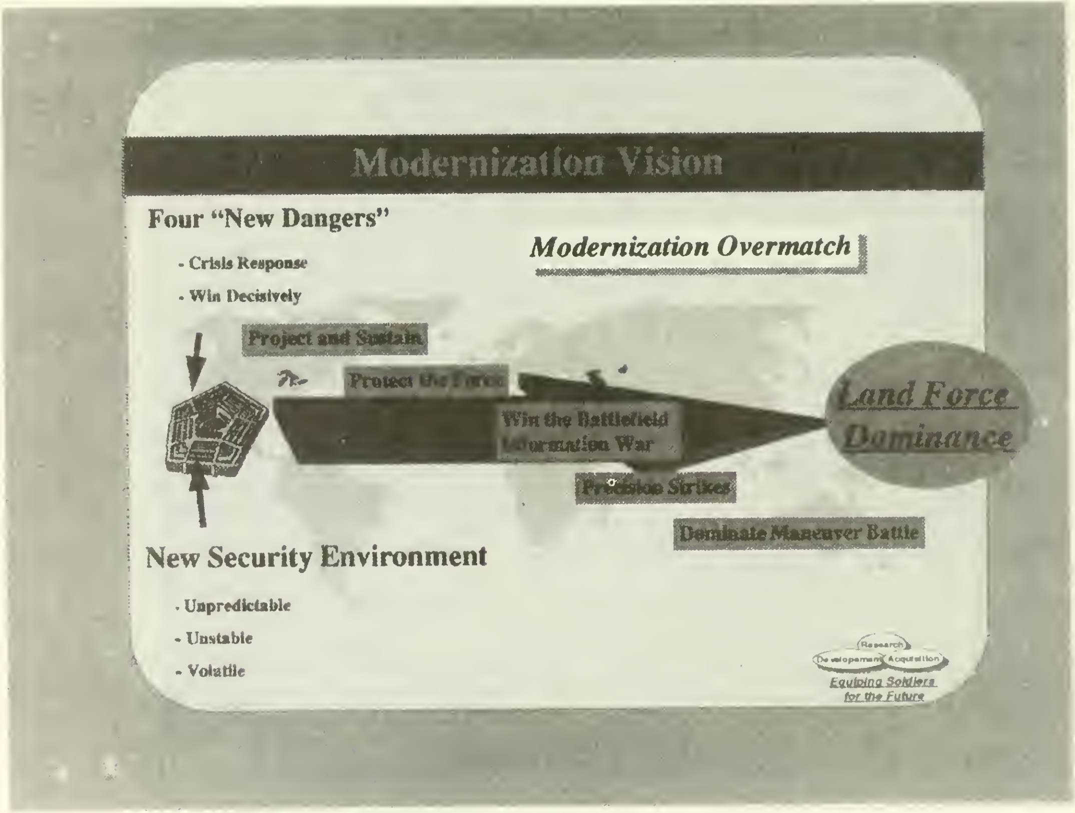
Research
Development Acquisition
Equipping Soldiers for the Future



How to Fight

Joint

Joint and Combined Arms Team across the Breadth and Depth of the Battlefield



Modernization Vision

Four "New Dangers"

- Crisis Response
- Win Decisively

Modernization Overmatch

Project and Sustain

Protect the Force

Win the Battlefield Information War

Precision Strikes

Dominate Maneuver Battle

Land Force Dominance

New Security Environment

- Unpredictable
- Unstable
- Volatile

PROJECT AND SUSTAIN THE FORCE

INTER AND INTRA THEATER LIFT

RAPIDLY DEPLOYABLE LETHALITY

INTEGRATED LOGISTICS
- CONUS BASED
- FORWARD SUPPORT

PROTECT
THE FORCE

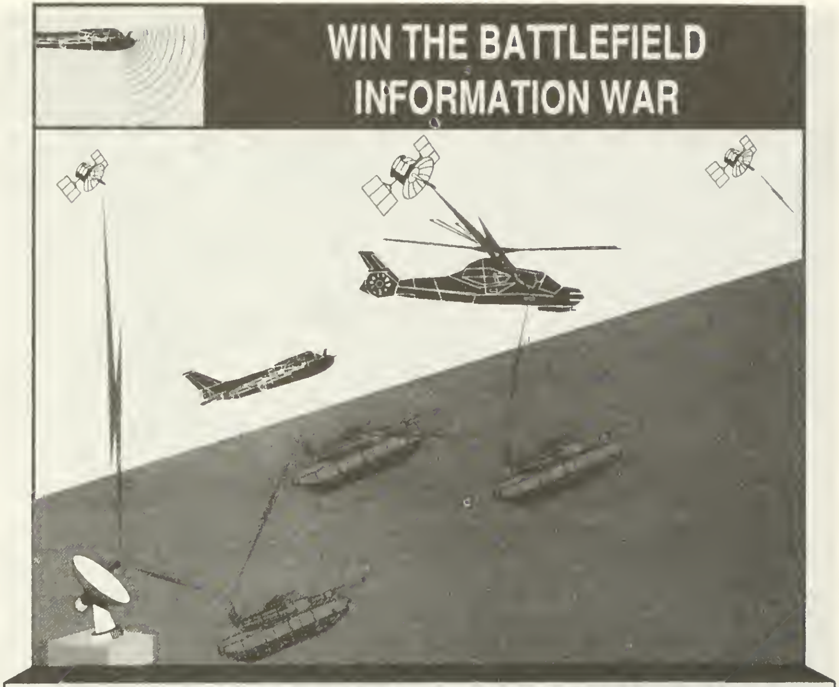
NBC

COMBAT ID

AIR DEFENSE

COUNTERFIRE

WIN THE BATTLEFIELD INFORMATION WAR



"IRAQ LOST THE WAR BEFORE IT EVEN BEGAN. THIS WAS A WAR OF INTELLIGENCE, EW, COMMAND AND CONTROL AND COUNTER INTELLIGENCE. IRAQI TROOPS WERE BLINDED AND DEAFENED. MODERN WAR CAN BE WON BY INFORMATIKA AND THAT IS NOW VITAL FOR BOTH THE U.S. AND THE USSR.

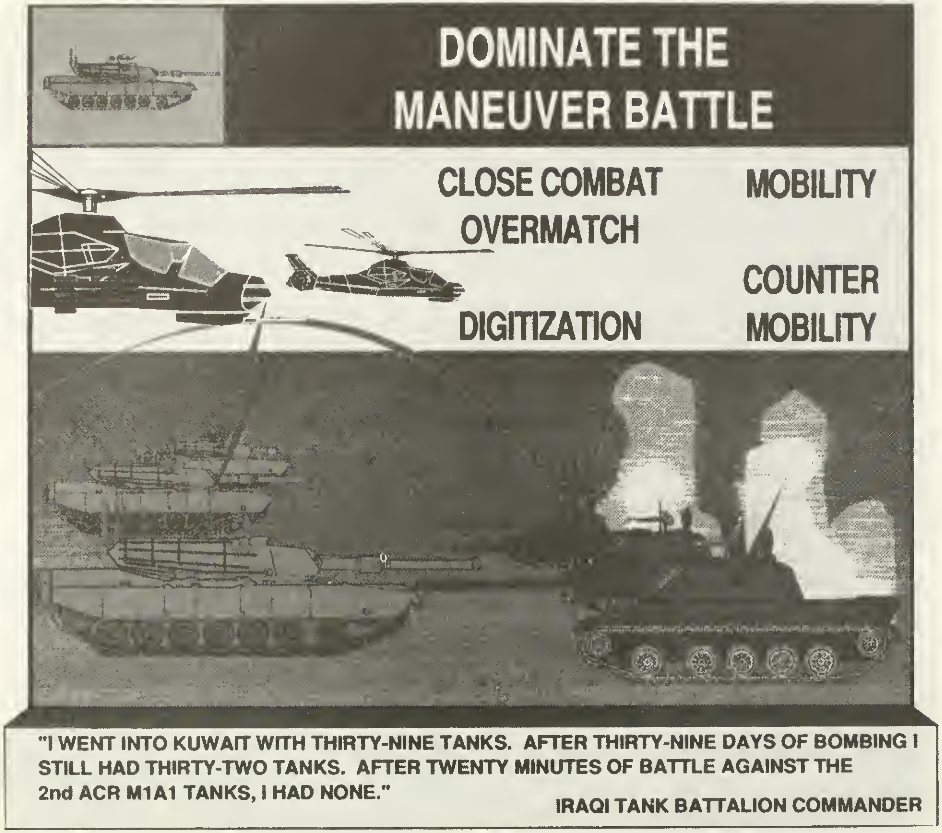
LIEUTENANT GENERAL S. BOGDANOV (OCTOBER 1991)
CHIEF OF THE GENERAL STAFF CENTER FOR OPERATIONAL
AND STRATEGIC STUDIES

CONDUCT PRECISION STRIKES THROUGHOUT THE BATTLEFIELD

TARGET TYPE
- HARD (HVY MNVR FORCES)
- SOFT (C3I FACILITIES)

DWELL TIME
- MOVERS
- SHORT (NEAR INSTANTANEOUS)
- LONG

RANGE
- CLOSE
- DEEP



DOMINATE THE MANEUVER BATTLE

CLOSE COMBAT OVERMATCH

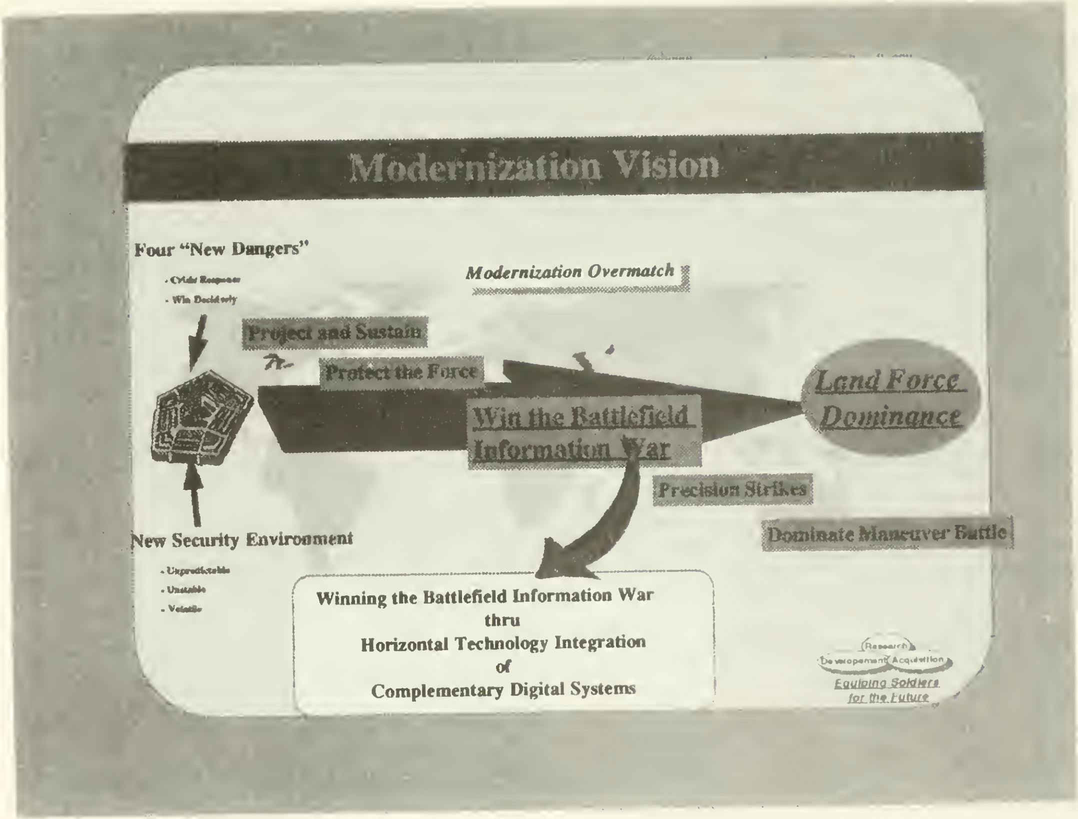
DIGITIZATION

MOBILITY

COUNTER MOBILITY

"I WENT INTO KUWAIT WITH THIRTY-NINE TANKS. AFTER THIRTY-NINE DAYS OF BOMBING I STILL HAD THIRTY-TWO TANKS. AFTER TWENTY MINUTES OF BATTLE AGAINST THE 2nd ACR M1A1 TANKS, I HAD NONE."

IRAQI TANK BATTALION COMMANDER



Modernization Vision

Four "New Dangers"

- Crisis Response
- Win Decisively

New Security Environment

- Unpredictable
- Unstable
- Volatile

Modernization Overmatch

Project and Sustain

Protect the Force

Win the Battlefield Information War

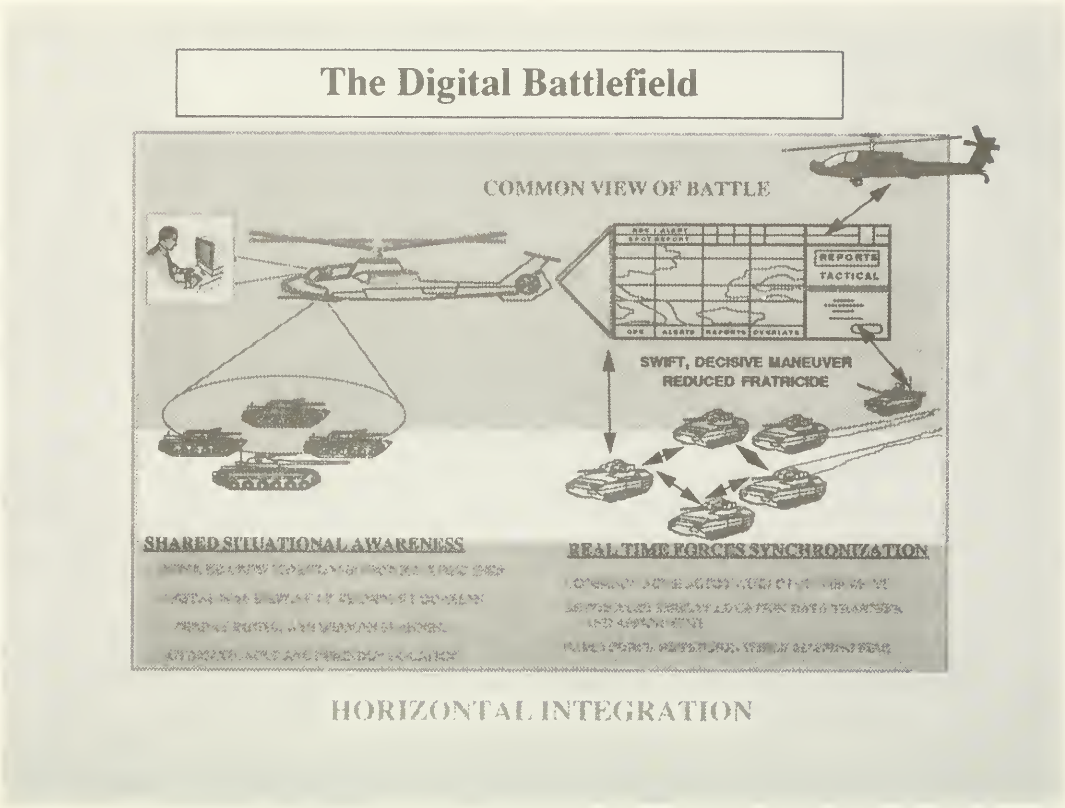
Precision Strikes

Dominate Maneuver Battle

Land Force Dominance

Winning the Battlefield Information War
thru
Horizontal Technology Integration
of
Complementary Digital Systems

Research
Development Acquisition
Equipping Soldiers for the Future



The Digital Battlefield

COMMON VIEW OF BATTLE

SWIFT, DECISIVE MANEUVER
REDUCED FRATRICIDE

SHARED SITUATIONAL AWARENESS

[illegible]

[illegible]

[illegible]

[illegible]

REAL TIME FORCES SYNCHRONIZATION

[illegible]

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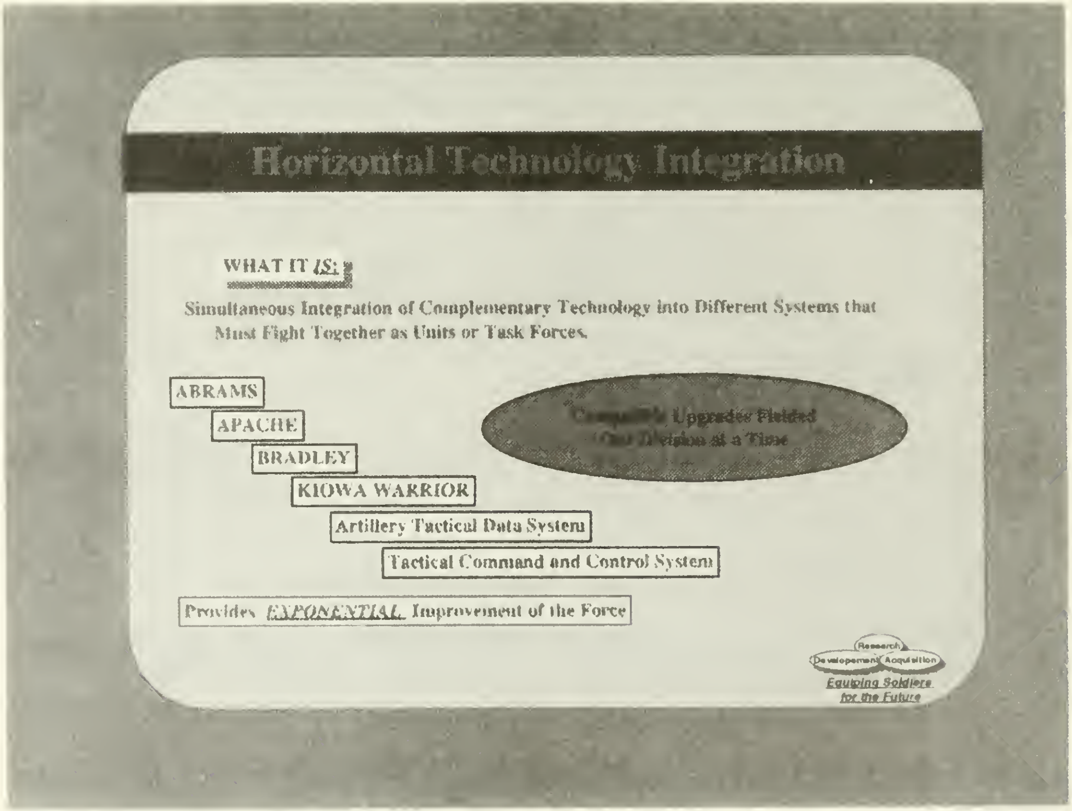
HORIZONTAL INTEGRATION



Horizontal Technology Integration

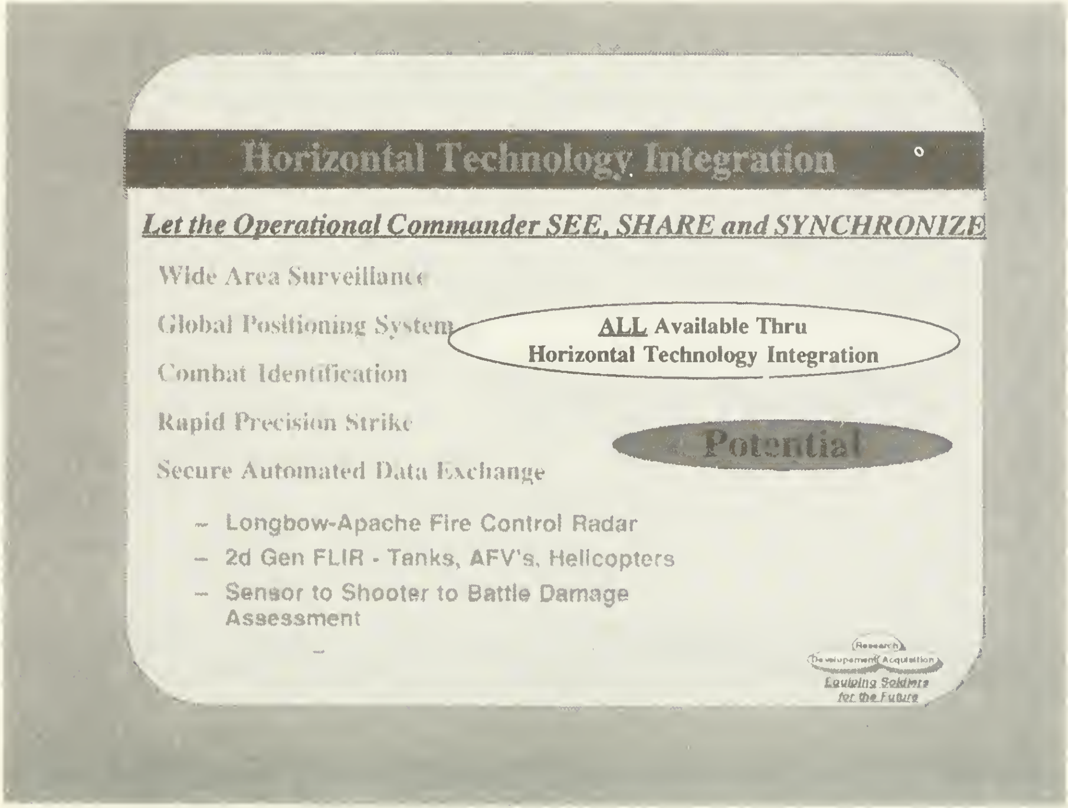
WHAT IT *IS*:

Simultaneous Integration of Complementary Technology into Different Systems that Must Fight Together as Units or Task Forces.

ABRAMS
APACHE
BRADLEY
KIOWA WARRIOR
Artillery Tactical Data System
Tactical Command and Control System

Compatible Upgrades Fielded
One Division at a Time

Provides *EXPONENTIAL* Improvement of the Force



Horizontal Technology Integration

Let the Operational Commander SEE, SHARE and SYNCHRONIZE

Wide Area Surveillance

Global Positioning System

Combat Identification

Rapid Precision Strike

Secure Automated Data Exchange

- Longbow-Apache Fire Control Radar
- 2d Gen FLIR - Tanks, AFV's, Helicopters
- Sensor to Shooter to Battle Damage Assessment

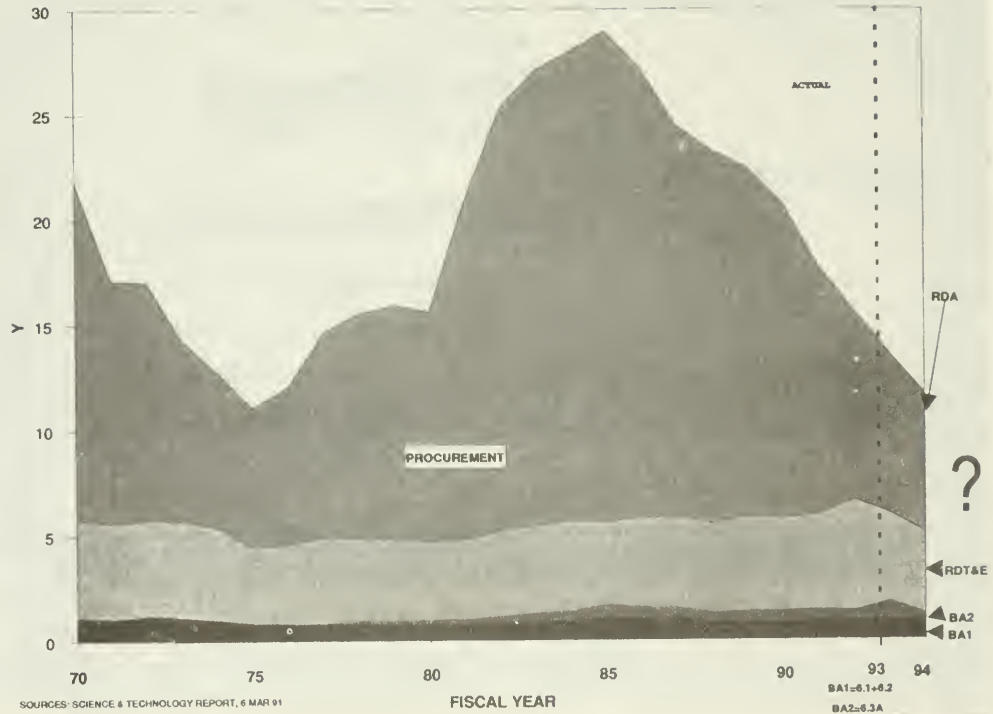
ALL Available Thru
Horizontal Technology Integration

Potential

Research
Development Acquisition
Equipping Soldiers for the Future

ARMY RDA BUDGET TRENDS

FY93 CONSTANT DOLLARS



SOURCES: SCIENCE & TECHNOLOGY REPORT, 6 MAR 91
FY93 APPROPRIATION
FY94 AMENDED PRESIDENT'S BUDGET, MAR 93

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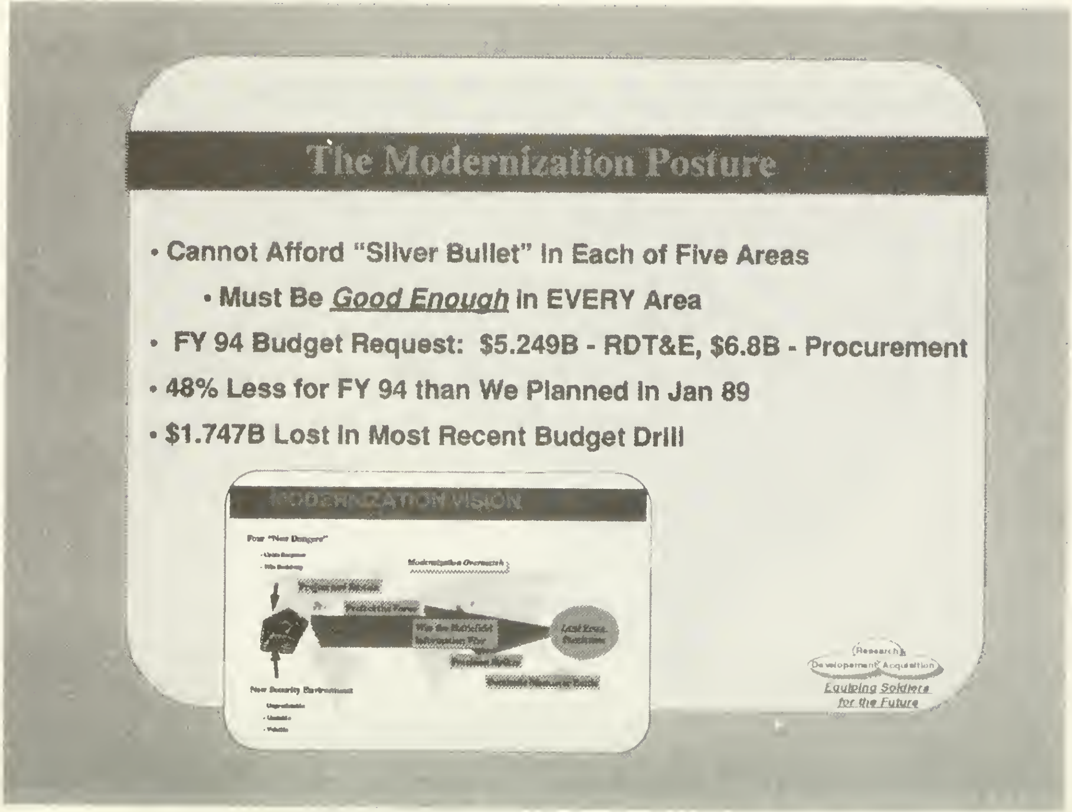
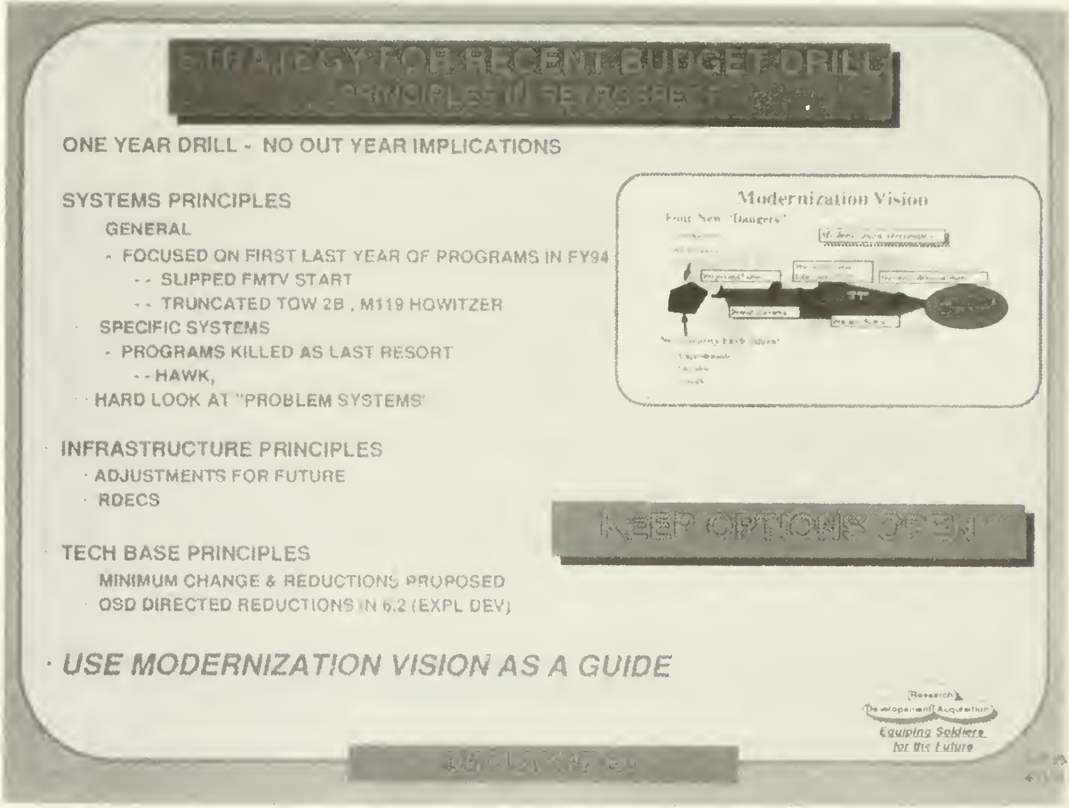


The Modernization Posture

- Cannot Afford "Silver Bullet" In Each of Five Areas
  - Must Be *Good Enough* In EVERY Area
- FY 94 Budget Request: $5.249B - RDT&E, $6.8B - Procurement
- 48% Less for FY 94 than We Planned In Jan 89
- $1.747B Lost In Most Recent Budget Drill

MODERNIZATION VISION
Four "New Dangers"
Modernization Overmatch
New Security Environment

Research Development Acquisition
Equipping Soldiers for the Future



STRATEGY FOR RECENT BUDGET DRILL

PRINCIPLES IN RETROSPECT

ONE YEAR DRILL - NO OUT YEAR IMPLICATIONS

SYSTEMS PRINCIPLES

- GENERAL
  - FOCUSED ON FIRST LAST YEAR OF PROGRAMS IN FY94
    - SLIPPED FMTV START
    - TRUNCATED TOW 2B , M119 HOWITZER
- SPECIFIC SYSTEMS
  - PROGRAMS KILLED AS LAST RESORT
    - HAWK,
- HARD LOOK AT "PROBLEM SYSTEMS"

INFRASTRUCTURE PRINCIPLES

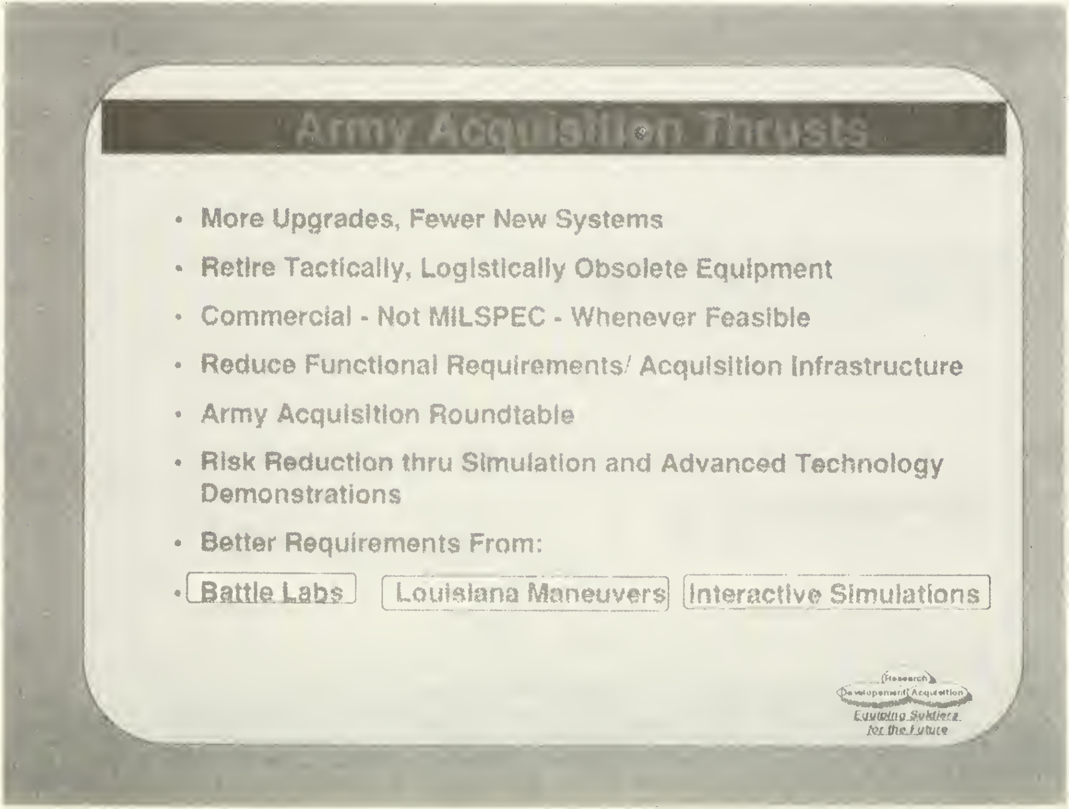
- ADJUSTMENTS FOR FUTURE
- RDECS

TECH BASE PRINCIPLES

- MINIMUM CHANGE & REDUCTIONS PROPOSED
- OSD DIRECTED REDUCTIONS IN 6.2 (EXPL DEV)

KEEP OPTIONS OPEN

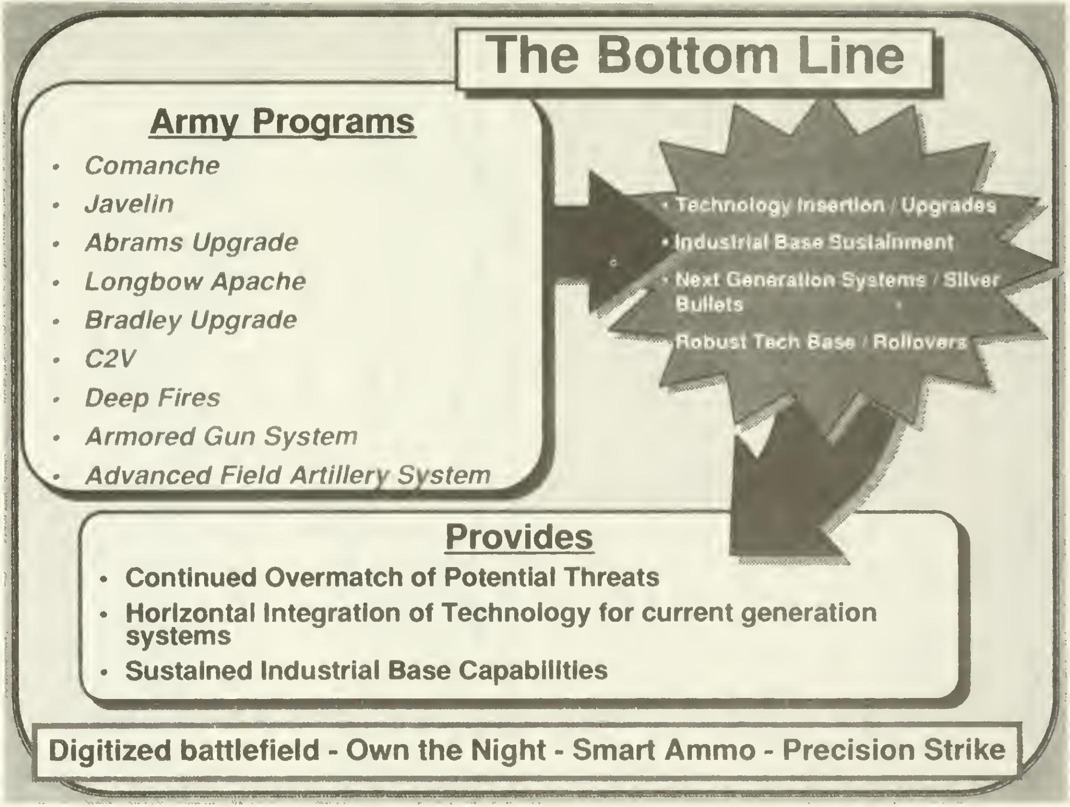
- ***USE MODERNIZATION VISION AS A GUIDE***



Army Acquisition Thrusts

- More Upgrades, Fewer New Systems
- Retire Tactically, Logistically Obsolete Equipment
- Commercial - Not MILSPEC - Whenever Feasible
- Reduce Functional Requirements/ Acquisition Infrastructure
- Army Acquisition Roundtable
- Risk Reduction thru Simulation and Advanced Technology Demonstrations
- Better Requirements From:
- Battle Labs | Louisiana Maneuvers | Interactive Simulations

Research Development Acquisition
Equipping Soldiers for the Future



The Bottom Line

Army Programs

- *Comanche*
- *Javelin*
- *Abrams Upgrade*
- *Longbow Apache*
- *Bradley Upgrade*
- *C2V*
- *Deep Fires*
- *Armored Gun System*
- *Advanced Field Artillery System*

- Technology Insertion / Upgrades
- Industrial Base Sustainment
- Next Generation Systems / Silver Bullets
- Robust Tech Base / Rollovers

Provides

- Continued Overmatch of Potential Threats
- Horizontal Integration of Technology for current generation systems
- Sustained Industrial Base Capabilities

Digitized battlefield - Own the Night - Smart Ammo - Precision Strike

RDT&E BUDGET REQUEST

Mr. Murtha. I am looking at RDT&E. I don't see it coming down that dramatically. I see it staying level. Compared to your procurement budget, RDT&E is staying level, especially if you add BA1 and BA2 into it.

[Clerk's note.—The chart referred to is printed on page 45.]

General Forster. Yes. We have done that at the expense of some procurement because we felt it was important to maintain the technology base and to keep the R&D programs going for the future.

These are not things that you can stop and start over again. We have fought hard to do it.

The fiscal year 1994 budget was the first time we got an indication of a tic mark coming down the R&D base. One year doesn't make a trend, but it certainly sends a warning signal to us and it is time that we start moving to help ourselves to the extent that we can in this area.

Mr. Murtha. Mr. McDade.

Comanche Helicopter Program

Mr. McDade. Thank you very much, Mr. Chairman.

General, welcome. I would like to bring your attention to the Comanche, which we know has been one of the high-effort priorities of the Army. Is it still?

General Forster. Yes, sir. It remains the centerpiece of our modernization plan. It is the only system that we have that fits all five modernization categories.

COMANCHE ALTERNATIVES

Mr. McDade. We hear that there are a series of options being looked at in the Pentagon, and they range form upgrading other helicopters, terminating Comanche, continuing development of Comanche and delaying upgrades to the AH–64's and OH–58's. What are your views on the various alternatives?

General Forster. The Army is strongly in favor of our baseline program, which is to continue development of Comanche on the present schedule. That is not as fast as we would like, but that is as fast as we can afford to bring the technology along and at the same time, in the near-term, put the Longbow on the Apache and do the modest upgrades associated with that. We think that that is appropriate.

It gets a near-term capability on the Apache out to match the tank and Bradley upgrades, and at the same time it focuses us on the long-term payoffs of the Comanche program.

COMANCHE FUNDING

Mr. McDade. What is the amount in the FY 1994 budget for Comanche.

General Foster. $367 million, including the T–800 engine.

Mr. McDade. Are you able to say that the program is going to be fully funded in the outyears?

General **Foster**. Yes, sir. In December, we got the final budget adjustment in preparation for fiscal year 1994 that let us fund it through Engineering and Manufacturing Development [EMD].

JOINT HELICOPTER PROGRAM

Mr. **McDade**. We hear there are voices saying that there ought to be a new prototype helicopter that would be suitable for Army, Marine Corps, and Special Forces, et cetera. What are you views on that?

General **Forster**. I have not heard a big groundswell of support for that, so I don't know a lot of details. I think that the missions that we would expect it to do across the Services are so different that you would have a camel with a rotor blade by the time you finished the design.

Mr. **McDade**. What about the Marine Corps—a lot of people think the Comanche should be viable for a Marine mission.

General **Forster**. It is a candidate for them to look at beyond the year 2000 to replace their Whiskey model Cobras. They may choose to go to another level of technology beyond that. We talked to them about the Comanche. They know where we are going. We are free and open in providing them access to the program so they will be able to make a logical decision based on their requirements.

COMANCHE BUY

Mr. **McDade**. We hear the buy may go as low as 800 choppers. Is that in your view a realistic buy?

General **Forster**. I can't comment on the 800. We will buy Comanches for the force structure that is appropriate for the Army in the 2000 year time frame. It is designed to go to our heavy and light forces, as well as the Reserve components. So it will be a decent buy.

Mr. **McDade**. Our concern would be, if you get down to a level of 800, is it still affordable?

General **Forster**. It probably will be. Remember, we only bought 811 Apaches. The unit price was high because you had to disperse the overhead over a smaller number. We decided Black Hawk was appropriate to buy at 1107. That was the acquisition quantity to begin with.

So we can make 800 Comanches a reasonable buy. We think it will be a larger number.

One of the things we are working on now is to, while we have time and before we start getting into the engineering and manufacturing development, figure out a way to work and develop it in such a way that there are opportunities for flexible manufacturing so that we can decouple the unit cost from the quantity that you buy. That is not easy, but it is possible.

So we are trying to come up with and are continuing to work through the development program so that it would support a production program like that, so we won't have huge cost increases with small decreases in quantity.

Mr. **McDade**. Whatever you would do, you would find a way around it, in your judgment?

General **Forster**. Yes, sir.

COMANCHE WEIGHT PROBLEM

Mr. McDade. Some people say there was a weight problem in development of the Comanche. Is that accurate?

General Foster. No, not that we have a problem. What we have done caused some confusion is, we included some kits that were like additional aircraft survivability equipment and additional armor protection for the pilot, that would be added on for specific missions in specific threat environments. Before we didn't include those in the base weight of the aircraft. We decided that that was misleading and it was getting to be a bookkeeping problem, so we rolled those kits into the weight of the aircraft, and that made it go up a couple hundred pounds.

Plus we have added about a 230-pound error or allowance for growth. When you add those two, it keeps it below the 8,000-pound magic number. It is no longer 7,500 pounds because we added a bunch of kits—it is 7,700 and we were giving them about a 200-pound latitude. You will see a number as high 7,900, but we don't expect it will take that much.

Mr. McDade. As far as you are concerned, the program is on track?

General Forster. The contractors have performed remarkably well since the restructure.

Mr. McDade. The restructure is funded properly in the outyears?

General Forster. Yes, sir.

Mr. McDade. Put the pertinent milestones into the record.

General Forster. We are still looking for first flight in fiscal year 1995.

Mr. McDade. Thank you, Mr. Chairman.

Mr. Murtha. Mr. Visclosky.

FUTURE MUNITIONS PACKAGING

Mr. Visclosky. Last year the Congress proposed $2.8 million to support a program for standardization and consolidation in advancement of future munitions packaging technologies. Why has the Army chosen to ignore the congressional directive?

General Forster. Let me check with my experts on that.

I think those dollars have not been provided to us yet. That is one that I don't recognize by that title.

Mr. Visclosky. Let me go on to another line of questioning.

General Forster. The dollars were never given to us because it was an add-on and withheld as part of the billpayer.

Mr. Visclosky. If the Committee decided not to use these monies for the Somalia reprogramming, what would the Army plan to do with the $2.8 million:

General Forster. Our intent would be to go back and use those funds as you directed for the standardized package. We would not use them for anything else without getting your views on that.

Mr. Visclosky. What would be required in fiscal year 1994 and beyond to complete the R&D efforts?

General Forster. It looks like three-quarters of a million dollars more in FY 95 and half a million dollars more in FY 96. About another half a million dollars in FY 97 would be the additional dollars we would require.

OVERHEAD RATES

Mr. Visclosky. General, let me talk to you about overhead rates. One of the problems facing the Department's acquisition program is contractor overhead cost because of the decline in their business base. It is due to their losses on other canceled and delayed programs.

What is the Army planning to do in the near term of fiscal year 1993 and 1994 to force the contractors to get a better handle on their overhead cost, and what is your projection in terms of the longer terms?

General Forster. First of all, we want to work with the Defense Logistics Agency (DLA) and their contract management to ensure that only allowable costs are put into overhead cost. We have to enforce the laws on the books first, and we are working with them through their contract management activities to do that. We don't see a lot of abuses. There are some differences in interpretation, but we will work with them on that.

LOW VALUE ADDED CONTRACTS

We have done two things—we have gone out on what we call a "road show" and basically said that we are putting things into our request for proposal that are finding their way into contracts that are very low value added and cause the contractor to do work that doesn't contribute to the specific program, in many cases because that is always the way we have done it, and in many cases because that is a job benefit or somebody protecting their turf.

We have to be ruthless when we take those things out and not allow them to find their way into a contract. They may be deliverables, but there are many things on top of that. These may fall into logistics studies or engineering analyses or reformatting a test result into specified government format and kicking it back and forth with written comments. That adds overhead, and we are trying to take that out everywhere we can.

The other thing we are doing on the government side is also to go out and make sure that we are not allowing any of our government people to generate requirements that would just keep them busy and generate a workload within, say, AMC or program management offices.

So we are looking at taking out those functional requirements that are low value added, whether it be on the government or contractor side or a combination of the two, and getting the cost of the contract down to the bare bones so you have less and less of the so-called "overhead people," the logistics analyzers, the testers, the kind of out-of-the-mainstream engineers working on a contract and sending memos back and forth to each other. That is one area we are working, as well as working with DLA to enforce the limits of the law.

We have had the road show go to all Program manager shops and major supporting commands. We have had a specific review of manpower requirements at the Communications Electronic Command. They are doing well, and we will continue to check that out.

ACQUISITION REFORM

Long-term, one of the things I would like to do as part of the acquisition reform that the Office of the Secretary of Defense will be going through is to make sure that we streamline regulations and documentation requirements and all those things that are above the Army to eliminate, so that they don't show up as functional requirements in contracts and we have somebody writing a report and somebody else reformatting it so it can be submitted to the government. That will be under Dr. Deutsch, the Defense acquisition executive. We will be part of it, but it will be his responsibility to do that.

The other thing, of course, is to try to get away from military specifications for hardware and for software, so that we can use more commercial equipment and allow contractors to not have one accounting system for military contracts and a different accounting system for their commercial business and better able to work those together so that everybody gets the advantage of that. That is a long-term solution, but it should come out of this acquisition policy review.

Mr. VISCLOSKY. Has the Department set a date when they would like that review to be completed and recommendations put forth?

General FORSTER. I have not seen a date. There is work going on already. Mr. Singley is participating in one part of that.

There is another part that the Defense Science Board is looking at. I would say this fall they will have an agenda where they are going to go. I don't know if you are familiar with the Section 800 report. This is a report done by acquisition personnel that documented the legal requirements that need to be changed in order for us to do better contracting and better contract administration. That has kind of been adopted as part of this reform. As it goes through, it will come here in various recommended legislative packages, probably beginning this fall.

RDT&E BUDGET

Mr. VISCLOSKY. The Chairman referenced a graph showing that the amount of money spent for R&D has been relatively constant since the 1970s. My understanding is R&D for the Army takes up about 14 percent of the Department's RDT&E budget, lower than any of the other services or the Department itself.

Any comment?

General FORSTER. I will take the high ground and tell you that one of the reasons for that is that R&D includes not just basic science and technology but R&D of major weapon systems. We don't have in the Army development programs for weapon systems as costly as the B–2, the F–22, the *Seawolf* submarine. So you don't have a huge base of R&D associated with a major program like that.

Our big-effort R&D program is Comanche at approximately $367 million a year, and there are other programs in other services to get to where they want to go, rightly or wrongly, that are over a billion dollars in any one year R&D. We don't have as expensive systems and programs as the other services, and that really drives the top line of R&D more than anything else. We do put as much into basic science and technology as the other services, even though their total R&D bill may be higher.

Mr. Viscolsky. My sense is that one of the problems is deferral or stretch-out of modernizations programs, you have this bottom-up review at the Department, and you will probably see adjustments recommended by the Congress. With that fluid situation, are there one or two systems that you see that the Army would want to prioritize for getting that modernization system into the field sooner rather than later?

General Forster. There is. Our overall priorities remain with Comanche and then with the Advanced Field Artillery System. But they are beyond the year 2000 programs where we have to do basic R&D on them first. The areas we would like to accelerate, if we had the money—and these things are considered despite not having the money—is to try to get the Bradley upgrades moved forward, the command and control vehicle moved forward, and the Longbow Apache moved forward so that they are more in sync with the M1 upgrades. That gives us the digital capability along all the major fighting elements at the same time. Bradley and Longbow Apache are upgrades to existing systems. The Command and Control Vehicle integrates existing communications equipment into a shelter mounted on a new production chassis. They are R&D programs.

But those are the things that we would look at to move forward. We initiated the Bradley program in fiscal year 1994 despite budget pressures, because we think it is such an important program to have compatible with the tanks.

Mr. Visclosky. Could you supply the committee with the dollar figures of what you think R&D would be necessary for the program as specified?

[The information follows:]

The pacesetter for digitization of the maneuver battlefield is the Abrams upgrade program. The Abrams upgrade program is on-track and adequately resourced to field one division of the Continental United States Contingency Force by fiscal year (FY) 1997. It is desirable to accelerate the Bradley upgrade, Command and Control Vehicle, and Longbow Apache research and development (R&D) programs to complement the Abrams upgrade program and implement battlefield digitization sooner. The resources required to accelerate R&D for these programs are:

[R&D; $ in Millions]

	FY94	FY95	FY96	FY97	FY98
Bradley Upgrade Program:					
Current Program	46.0	110.3	110.6	80.5	18.9
Change	+33.1	+50.0	0	−35.1	−18.9
Resulting Program	79.1	160.3	110.6	41.1	0
Command and Control Vehicle:					
Current Program	8.7	14.7	15.9	3.8	
Change	+20.3	+4.3	−11.9	−3.8	
Resulting Program	29.0	19.0	4.0	0	
Longbow Apache:					
Current Program	278.0	126.9	9.4		
Change	+44.4	+13.8			
Resulting Program	332.4	140.7	9.4		
Additional R&D Funds Required:					
Total Change	+97.8	+68.1	−11.9	−38.9	−18.8

Technical and programmatic considerations prevent precise alignment of these R&D programs. However, the increases proposed to the current funding levels will support the earliest possible completion of the R&D for each program, and allow earlier fielding of a digital capability across the key ground and air systems of the maneuver force.

Mr. MURTHA. Mr. Livingston.

ANTI-SATELLITE (ASAT) PROGRAM

Mr. LIVINGSTON. With respect to ASAT, the amount of money needed in fiscal year 1994 to complete the DEM/VAL phase is in the range of $20 to $25 million. Is that correct, and is this the last year of RDTE for ASAT?

General FORSTER. The ASAT program——

Mr. LIVINGSTON. The ASAT Kinetic Energy, yes.

General FORSTER. That sounds like a reasonable number, but I don't think that is the last year to really complete a good DEM/VAL program on it.

Mr. LIVINGSTON. The program is going to be eliminated according to the FY94 budget. Right?

General FORSTER. Yes, sir. It is not one of those programs that we feel that we can bring in within the overall R&D budget that we face in the future. It will push some near-term war fighting things out, and it did not stand the priority test.

Mr. LIVINGSTON. That doesn't, I take it, eliminate the ASAT program. You are just dropping out this phase; is that correct?

General FORSTER. Out of that particular program. There are other ASAT programs that continue, not necessarily in the Army, but throughout DOD.

Mr. LIVINGSTON. I have a number of other questions. I will submit them for the record, Mr. Chairman and yield to my friend from Georgia.

[CLERK'S NOTE.—Questions submitted by Mr. Livingston and the answers thereto follow:]

ANTI-SATELLITE (ASAT) PROGRAM

Question. The Fiscal Year (FY) 1994 request did not contain funding for the Kinetic Energy (KE) ASAT—was the elimination of this funding made at the Service level or at OSD (and why)?

Answer. KE ASAT was not funded in the Army's FY94 budget submit. The Office of the Secretary of Defense did not restore funding to the KE ASAT Project in the FY94 President's Budget. The Army recognizes and supports the need for a U.S. KE ASAT capability, but acquisition of a KE ASAT system is not affordable in light of budget reductions and program priorities.

Question. I understand that recent statements on emerging reconnaissance satellite threats of U.S. battlefield forces have been made by CINCSPACE Commander Charles Horner and General McPeak? Can you comment on what these statements were?

Answer. Both General Horner and General McPeak have reiterated the critical importance of space control to our future warfighting capability. A key element of space control is the ability to deny an enemy access to satellite derived intelligence information on U.S. and allied forces, movements, and capabilities. There are many potential scenarios in which the only effective means to deny this information would be to destroy or disable the adversary's spacecraft using an ASAT weapon.

Question. What is the threat?

Answer. The most direct threat is the ability of an enemy to use reconnaissance satellites to locate, track and target U.S. and allied forces and installations. Coupling a satellite targeting capability with long range theater ballistic missiles would give a future adversary the ability to find and attack U.S. forces from relatively secure positions. Other types of satellites (e.g., navigation, communication, weather, missile warning) have proven to significantly increase the effectiveness of ground, sea and air forces in modern warfare. There is little doubt that other countries will try to develop or acquire these capabilities for themselves. In future conflicts the U.S. may need the ability to neutralize these capabilities in order to maintain critical advantage for our own forces.

Question. Do you feel that there is a threat for which we have no ASAT capability?

Answer. There is clearly a trend for some countries to develop or purchase militarily significant space capabilities that could represent a very real threat to U.S. forces in future conflicts. Currently the U.S. has no operational ASAT capability. While this may be acceptable for situations in which we enjoy vast space superiority over our adversaries, the continued proliferation of space systems may result in significant risks to our ability to successfully accomplish future military actions unless we possess some means of negating an enemy's space systems.

Question. Last year's Defense Authorization Conference Report required a report (including an operational requirements document) by March 15th on the KE ASAT program. When will this report be sent to Congress? Why hasn't it been sent yet?

Answer. In response to this Congressional direction, the Army prepared and forwarded to OSD both a revised Operational Requirements Document (ORD) and a proposed plan for downsizing and restructuring the program consistent with the new requirements. It is our understanding that OSD wants to consider ASAT requirements in the context of its overall bottom up review of future defense requirements before responding to this specific request.

Question. What level of funding would be required in Fiscal Year (FY) 1994 to complete the Demonstration/Validation (DEM/VAL) Phase?

Answer. Approximately $35 million is required in FY94 to complete the current, limited DEM/VAL Phase.

NUTRITION RESEARCH

Question. Last year both the House and the Senate provided an increase of $1.75 million above the request under Program Elements (PE's) 061102A, 0602787A & 0603002A specifically for ongoing military nutrition research (only) projects at Pennington Biomedical Research Center. Previous testimony and information from the Army shows that these projects have provided worthwhile research for our services. However, I understand that may be as much as $750,000 of the $1.75 million appropriated last year has not been provided to these projects? Is this true? Explain. These are projects of Congressional interest, have the subcommittees been notified of changes in the fiscal year (FY) 1993 funding for these projects?

Answer. In fiscal year (FY) 1993, Congress provided $1.75 million above the request only for nutrition research, stating that "this funding is available to continue ongoing nutrition research projects on stable isotope energy assessment, nutritional neuroscience research, and nutrition and military performance clinical laboratory research. The Committee also directs that this funding be used on new military nutrition research projects of importance to the Army, including menu modification and clinical nutritional neuroscience research, utilizing existing cooperative agreements between the Army and unique clinical research and stable isotope laboratories. The Committee directs the Army and the Department to budget for FY94 and beyond." These funds were released to the Army Medical Research and Development Command (MRDC) in incremental amounts. The final release, $750,000, occurred in May 1993. Consequently, there have been no changes in FY93 funding for these projects.

Question. Detail for the record (by PE) the breakout of the FY93 funding provided thus far for these projects as well as what projects (if any) the remaining funds have been used for.

Answer. These Congressionally directed funds have been allocated as follows:

PE 061102A—$250,000 (Defense Research Sciences)
PE 0602787A—$750,000 (Medical Technology)
PE 0603002A—$750,000 (Medical Advanced Technology)

Question. Provide for the record a breakout of the funds requested for these research efforts and the PE lines listed above in FY94.

Answer. As part of the Army's overall plan, to identify nutritional strategies to maintain health and enhance soldier performance in all operational environments, MRDC has programmed the following funds for nutrition research in FY94:

	(In-house)	(Pennington)	(Other contract)
PE 061102A/BS15	$82,000	$42,000	$411,000
PE 0602787A/A879	805,000	230,000	0
PR 0603002A/D819	0	0	0

Question. Provide an update for the record the significance of the research being conducted at Pennington for the Army.

Answer. The nutrition research projects identified in the Congressional language are conducted at the Pennington Biomedical Research Center under the terms of a multi-year Cooperative Research Agreement with MRDC. The projects are jointly planned and integrated with the in-house military nutrition research program conducted by the U.S. Army Research Institute of Environmental Medicine for Department of Defense (DoD). All projects are peer reviewed by the National Academy of Sciences' Committee on Military Nutrition Research. The projects at Pennington enhance our capabilities in nutritional neuroscience to understand the basic mechanisms and exploit the complex role of specific nutrients (e.g. tyrosine) to enhance cognitive performance of soldiers under stress. The clinical nutrition and stable isotope laboratory projects are being used to assess the changes in biochemical indications of nutritional status and energy expenditures of female basic trainees, and Ranger and Special Forces trainees. The cost effectiveness of the nutritional health promoting menu modification project will be demonstrated at a Fort Polk, Louisiana enlisted dining facility.

GP-160 VACCINE TRIALS

Question. After a long scientific review required by law and despite Department of Defense (DoD) plans to proceed with a phase III study of only GP-160, a change by the Administration directed that the phase III clinical trial be transferred from DoD to National Institutes of Health (NIH), and that a multi-vaccine trial be held. As a leader in important AIDS research, what does the Army think?

Answer. In accordance with Administration guidance, the Army has initiated transfer of $20 million to the Department of Health and Human Services (DHHS). The National Institutes of Health (NIH), the principal medical research arm of DHHS, will be primarily responsible for designing and executing a large scale, phase III clinical investigation among Human Immunodeficiency Virus (HIV)-infected patient populations, consistent with the legislation. The NIH will be responsible for decisions concerning the exact number and identity of candidate vaccine products to be tested.

Transfer of these funds will permit rapid initiation of studies through NIH's large, established Acquired Immune Deficiency Syndrome (AIDS) Clinical Trial Group network of civilian medical research units throughout the United States. The studies are estimated to involve at least 6,000 and as many as 12,000 patients.

Question. I understand that NIH is requiring that any vaccines used in a multi-vaccine trial be donated. Is this true?

Answer. The Army has not been notified of any such requirement on the part of the NIH.

Question. Does Public Law (P.L.) 102-396 require that vaccines be donated for any trials?

Answer. There is no reference in P.L. 102-396 requiring that vaccines must be donated for any trials.

Question. Doesn't the law, P.L. 102-396, and the entire legislative history behind it require that GP-160 vaccine be used or tested?

Answer. P.L. 102-396 states: "That $20,000,000 of the funds appropriated in this paragraph may be made available in the Acquired Immune Deficiency Syndrome program element only for a large-scale Phase III clinical investigation of the GP-160 vaccine: Provided further, That the funds referred to in the preceding proviso may be obligated unless, within six months after the date of the enactment of this Act, the Secretary, of Defense, the Director of the National Institutes of Health, and the Commissioner of Food and Drugs submit to the Committees on Appropriation of the Senate and House of Representatives, a written certification that the large scale Phase III clinical investigation should not proceed, the reasons for that determination, and an assessment of the GP-

160 vaccine: Provided further, That if such certification is presented, the Secretary of Defense may use these funds only for other AIDS research needs of the Department of Defense."

[CLERK'S NOTE.—End of questions submitted by Mr. Livingston.]

REMOTELY PILOTED VEHICLE (RPV) PROGRAM

Mr. DARDEN. I thank the gentleman for yielding.

What happened to the Army RPV program? Do you have one right now?

General FORSTER. We have a very successful RPV program that is part of a joint program funded under an OSD budget line managed by a joint program office under the purview of the Navy. I guess they had an existing program office doing cruise missiles that was unfairly similar, so they gave them the mission to manage it. Admiral Wagner is the program executive officer for that, and then the Army provides two program managers to him and we do the smaller versions, the short-range and the close-range UAV's under the auspices of the joint program office.

The UAV short-range, we had a very successful early user test last summer, jointly conducted by the Marines and the Army. That program is now in low-rate production. We expect to have production models available for follow-on testing next year, and it should continue to move quite well.

The close-range is just beginning development now. We did the short-range first, which is a little bigger than the close-range, because we had better agreement on the requirements for that between the Army, Marines and Navy. So all three Services—Army, Marines, and Navy—will participate. The close-range is Army and Marines.

Mr. DARDEN. Go over the ranges. What would be a short-range?

General FORSTER. Short-range is capable of going out 200–300 kilometers beyond the line of contact. Close-range would go 50 kilometers into the enemy's area. Close-range is oriented on artillery capability for direct support of a division task force whereas short-range is an intelligence gatherer.

Mr. DARDEN. The old Aquilla, was that a short-range?

General FORSTER. Close-range capability, 40-kilometer range beyond the line of contact.

Mr. DARDEN. I take it that integrating these various RPV programs has been generally successful and you are pleased with the direction we are going?

General FORSTER. It has been generally successful, but not easy. There has been a lot of pulling and tugging among the services to get the compromises necessary to have unified requirements. But in general, it has worked very well.

Mr. DARDEN. Does this budget contain funds for that program?

General FORSTER. That comes out of a DOD line for procurement for all the services. You would find in our O&M account, though, money to support our Pioneer UAV unit and the UAV units that will get the short-range UAV in 1995.

Mr. DARDEN. Do you see a future for a UAV or RPV in a future combat scenario? Do you think it has a legitimate use?

General **Forster**. Yes, sir. I think there is no question about that. Unmanned Aerial Vehicles (UAV) are a high payoff capability that we need. It remains a priority for the Army and the Marines, in intelligence, electronic warfare, target acquisition and battle information mission areas. We used them with great success in Desert Storm, developed by the Marines or brought here by the Marines, because they were developed by the Israelis. The Army and Marines used them for target acquisition and that just revalidated their capability.

So we are strong supporters of UAV's. We feel they have a valid position in the Army in the future.

Mr. **Murtha**. Mr. Skeen.

HIGH ENERGY LASER SYSTEMS TEST FACILITY (HELSTF)

Mr. **Skeen**. Let's talk about HELSTF. I have a very close interest since this facility is in my Congressional district.

Earlier this week my office received a copy of a contract award which stated that $58.7 million had been awarded to Aerotherm Corporation to begin the phase-down and mothballing of HELSTF. Today, we received a revised announcement of this contract award which stated that the Army had terminated this amount of Aerotherm's contract, and that phase-down and mothballing operations would begin on April 26, 1993 to meet the September 30, 1993 closure date of Army presence at HELSTF.

This action has been somewhat confusing. My office had not been informed in advance of this contract award, and we were told the Army had not made a final determination to begin phase-down and mothballing of the facility.

Would you comment and clarify for the record your understanding and explanation of this action?

General **Forster**. Yes, sir. First, I will say I am in the same position as you are; I wasn't aware of that contract action until this morning. I think the revised announcement is poorly written and it is the same contract that you were told about earlier. It just got garbled up in transmission over here.

There was a task order written to the support contractor to come up with a plan on how to begin the phase-down of HELSTF. It also provided him a notice that there were no funds available to execute the option in fiscal year 1995, as it stood now, just prudent notice to the contractor that is what was in the Army budget request. It did not say your contract is canceled or anything like that. It was a descope of some 1993 work in order to include the phase-down effort, and then it was a notice that there were no funds and that the option for fiscal year 1995 and out years would not be executed.

In the meantime, we have the cart ahead of the horse. The initial plans on how to get at closing it down do not go in to the commander until 1 May. I have to say we are a little discombobulated as far as the schedule is concerned.

Mr. **Skeen**. It has been confusing. People working there, one minute there is hope, there is still life in the program, and then it is reversed. That is not unusual in restricted budget situations.

Last year, Congress directed the Department to report to the Congress on the tests scheduled at HELSTF for fiscal years 1993 and 1994, and its long-term plans for either maintaining the facility or transitioning it to a lower level of operations. Has this report been submitted to the Committee? If not, why not and when do you expect it to be submitted?

General FORSTER. The report has been completed. It outlined five options from closure of the facility up to increasing the pace of its test results. It has been submitted to the Department of the Army. It is in staffing and some goings back and forth with the Office of the Secretary of Defense. We have not gotten it out of the Pentagon yet.

Depending on the degree of disagreement, and the compromising and changes that have to be made, we could get it over here as early as a week, or two or three weeks from now.

Mr. SKEEN. Do you have the authorization to make the decision to close the facility without that report being submitted to the Committee?

General FORSTER. We think we probably do, but we think it is bad form. We think that we should have told you more than what we have about this.

Mr. SKEEN. It may not have been possible.

I would like to know for the record. If you don't want to submit it or just orally discuss it, submit it in writing as to how the determination was made and what alternatives were explored with the HELSTF before they made the decision to shut it down.

General FORSTER. It was surely an affordability issue, and we will elaborate on that for the record.

[The information follows:]

The determination to close the High Energy Laser Test Facility (HELSTF) was based on the lack of sufficiently funded test programs at the facility and the Army's need to realize a rational return on the annual investment of approximately $28 million. To date, we have not found the customer base which would support this sizable investment. The Army has been reimbursed $2.0 million in fiscal year (FY) 1991, $1.7 million in FY92, and approximately $0.6 million in FY93 by the customers using HELSTF.

Alternatives considered for HELSTF;

Alternative	Capability	Cost
I Closure	None	$13.0 million FY94; $0.0 million per year thereafter.
II Caretaker	Possible reconstitution; no laser RDT&E	$18.0 million F94; $2.0 million per year thereafter.
III Low Power	Tactical laser damage/vulnerability testing; some Laser RDT&E; large vacuum chamber and laser instrumentation.	$18.0 million FY94; $18.0 million per year thereafter.
IV High Energy	Strategic laser damage/testing; no instrumentation; mid-infrared chemical; laser/sea lite beam; detector test and evaluation with limited contingent anti-satellite.	$23.8 million FY94; $24.0 million per year thereafter.
V Full Site	Strategic and tactical damage vulnerability testing; low and high laser RDT&E; all laser RDT&E; all site support, instrumentation and upgrades.	$26.6 million FY94; $30.0 million per year thereafter.

Mr. Skeen. You mentioned that the RDT&E downsizing is important to keep your technology base. I think that with a smaller force technology is absolutely the basic support. If you close HELSTF, I think that you are losing a considerable and significant cornerstone of the technology development base.

I would like to just see the justification for it and what determination was made to do that.

[The information follows:]

The technology base is a key to the continuing improvement of our armed forces. In the current budget environment there are insufficient funds to buy every piece of the infrastructure that supports the technology base. The Army must prioritize where, and in what facilities, it invests its scarce resources. The determination to close the High Energy Laser Test Facility (HELSTF) was based on the lack of sufficiently funded test programs at the facility and the Army's need to realize a rational return on the annual investment of approximately $28 million. To date, we have not found the customer base which would support this sizable investment. The Army has been reimbursed $2.0 million in fiscal year (FY) 1991, $1.7 million in FY92, and approximately $0.6 million in FY93 by the customers using the HELSTF.

Mr. Skeen. Thank you, sir. I have some additional questions for the record.

Thank you, Mr. Chairman.

[Clerk's note.—Questions submitted by Mr. Skeen and the answers thereto follow:]

Question. Why is the Army proposing to make this decision without exploring other alternatives which would keep High Energy Laser Test Facility (HELSTF) operational during this fiscal year (FY)? (i.e. Navy or Air Force (AF) takeover of facility.)

Answer. Admiral Kelso has written General Sullivan requesting a delay in closing HELSTF. the Army is discussing future operation of the facility with the Navy but no financial arrangement or facility transfer is imminent. The AF has not been interested in HELSTF.

Question. It is my opinion that FY93 funds were appropriated to continue operating and testing at the facility, not to begin shutdown of the facility. How can the Army realign FY93 funding of a congressional special interest program without prior approval of the Congress?

Answer. Financial exigency prompted Army's decision to close the facility. It is prudent to initiate some actions in FY93 for an FY94 closure. FY93 resources will be examined as a possible source of funding because the funds available in FY94 are believed to be insufficient to accomplish the close down. Some planning for the close down must begin in FY93, and some long lead-time activities must begin in FY93. Additionally, notification of government workers of a possible reduction in force is required by civilian personnel regulations.

Question. What additional funding would be required to continue the operation of HELSTF in FY 1994 and in future years?

Answer. Supporting the Navy's Point Defense Demonstration test program would require an additional $20 million in FY 1994. Continued operation of the facility in future years would be approximately $30 million annually.

Question. The descriptive summary in support of HELSTF states that the facility provides a unique broad-based high energy laser Research, Development, Test and Evaluation capability at White Sands Missile Range to support tri-service high energy laser Research and Development and damage, vulnerability and lethality laser testing. The summary goes on to state the HELSTF is the only fully integrated laser test facility in the world, combining several lasers with an extensive array of instrumented test sites and the Sea Lite Beam Director (SLBD).

Another statement indicates that due to budgetary constraints the Army has been forced to re-examine the need for continued operation of all Army test facilities based on utilization and workload forecasts.

Was the decision to close HELSTF solely for financial reasons? If not, fully explain the Army's reasons.

Answer. Yes, there is insufficient demand through FY99 for high power laser testing and the funds necessary to maintain the facility ($21.8 million for R&D in FY94) are unavailable.

Question. Has the Army been reimbursed by the other services and agencies for their use of the test facility? if not, why not?

Answer. The Army has been reimbursed $2.0 million in fiscal year (FY) 1991, $1.7 million in FY92, and approximately $0.6 million in FY93 by the customers using the High Energy Laser Test Facility (HELSTF). This reimbursement is insufficient to justify the Army's annual investment of $20 million in HELSTF as a test facility.

Question. For the record, list all Army test facilities and indicate their utilization and workload for FY91, 92 and 93, and future forecasts for FY94 through FY99. Also, please provide the funding level for each facility for the same fiscal years.

Answer. This information is not available at the present time. It will be furnished by June 4, 1993.

[CLERK'S NOTE.—As of September 28, 1993, the Committee has not received the information.]

Question. Testing: FY93 funds are also being used to complete installation of the Laser Development Device; complete installation of an atmospheric compensation system; continue coordination for Strategic Defense Initiative Office Space Test Facility Development; and continue the test support program for 17 other programs.

What is the impact on these programs in FY94, if the Army closes this facility?

Answer. Programs ongoing in FY93 will be supported as much as possible within the requirement to fund curtailment of site operations. Those few programs originally planning to use HELSTF in FY94 will need to make other arrangements through their sponsoring service/agency.

Question. Beam Director: Congress appropriated an additional $10 million over the budget request in FY93 only for operation of the Sea Lite Beam Director (SLBD). What was accomplished with these funds?

Answer. All of the $10 million for SLBD has been or is being spent on testing. We have completed: Storm Theater Missile Defense target tracking tests; missile plume tracking experiments; and, Extended Range Interceptor Technology and Navy Lightweight Exoatmospheric Projectile tracking tests. Ongoing we have: Black Brant Infrared tracking testing; Navy standard missile tracking test; and, Navy/United Kingdom ship Point Defense Demonstration tests. National Aeronautical and Space Administration decided not to conduct the planned space power beaming experiment.

Question. What is the impact of the proposed closure of HELSTF to this program?

Answer. The SLBD, which provides the optics train, and the pointing and tracking capabilities for HELSTF, will be closed with the rest of the site.

Question. What is the Army's plan for this facility after closure?

Answer. The Army plans to transfer the HELSTF equipment to other services or agencies, as appropriate. Conduct an environmental clean-up, as required, and return real estate property to White Sands Missile Range, New Mexico.

[CLERK'S NOTE.—End of questions submitted by Mr. Skeen]

Mr. MURTHA. Congressmen Dicks, Hefner, and Young have questions they would like answered for the record.

[CLERK'S NOTE.—Questions submitted by Mr. Dicks and the answers thereto follow:]

FREE ELECTRON LASER (FEL)

Question. In December, the Army accepted the responsibility of the Free Electron Laser (FEL) from SDIO. What events caused the Army to change its support of the program, and then terminate the funding?

Answer. The FEL program was terminated because the Army's budget was significantly cut in February 1993 and the FEL had too low a priority in the Army to survive.

COMANCHE PROGRAM

Question. As you know I am a big supporter of the Army's Comanche program. I agree with your final statement that "Modernization is the key to tomorrow's readiness". I am extremely pleased to see in your statement the Army's commitment to this program. I believe that the Army desperately needs this helicopter, not just to address the world's threats with attack and intelligence capabilities, but to address the Army's own readiness problems.

Its my understanding the DEM/VAL phase was extended into 1997. When do you believe the Comanche will reach its initial operating capability? At this time, how old will the helicopters be which the Army is trying to replace? How many Comanches is the army planning to buy?

Answer. The projected initial operating capability date is January 2003. The Comanche will replace the Vietnam era OH–58A/C and AH–1 helicopters. The average age of the OH–58 and AH–1 will be approximately 34 years and 33 years, respectively. The current plan is to produce 1292 Comanche helicopters.

Question. Under the previous administration OSD was not very supportive of this program, and as a result, the Comanche went through some very rough times. Is the acquisition program back on track? Is this program fully funded through production? When do you anticipate production to start?

Answer. The Comanche program has gone through a very turbulent year by way of a costly restructure that has decreased funding which resulted in a stretched program. The first flight has been slipped one year to August 1995 and Milestone II by a couple of years to November 1997. The initial operational capability has been slipped five years to January 2003. The program is funded through the Future Year Defense Plan (FYDP). If there are no other slips in the program, Low Rate Initial Production (LRIP) is projected to commence in FY 2001.

Question. Is the program still technically feasible? Is the cost schedule still on track? Is it meeting all of the milestones? What obstacles do you see having to tackle in the near future?

Answer. The program is technically feasible. The Comanche government/contractor team is constantly investigating alternative techniques to reduce risks in terms of cost, schedule, and performance. The program is on track in both schedule and cost. Since restructuring, the Comanche program has met all milestones. The primary obstacle to contend with will be the realities of a reduced force structure and budget that will dictate intense and constant review throughout the development program. For the future, as in the past, the requirement for Comanche will remain strong.

[CLERK'S NOTE.—End of questions submitted by Mr. Dicks. Questions submitted by Mr. Hefner and the answers thereto follow:]

FREE ELECTRON LASER (FEL)

Question. It has been brought to my attention that the Free Electron Laser (FEL) program did not survive budget deliberations within the Army. I understand the Army had agreed to accept transfer of the FEL program from Strategic Defense Initiative Office (SDIO).

I believe the Army has managed this program for SDI since 1985. Has this program been successful or has it had problems?

Answer. The FEL program has met all program milestones within budget constraints. There have been several significant technology advances that met all developmental requirements and technical reviews. The low power FEL has near-term capabilities as a countermeasure against sea skimming missiles and laser radar image enhancing weapons systems. The FEL requires continued development to be ready for deployment as a space-based high power weapon.

Question. Why was the program terminated at this time?

Answer. The FEL program was terminated because the Army's budget was significantly cut in February 1993 and the FEL had too low a priority in the Army to survive.

Question. How much work remains to be done and are there any plans to reinstate the program?

Answer. The program, transferred to the Army by SDIO, planned to have a high average power FEL (10 kilowatt) demonstration by FY95 at a planned cost of $30 million. There are no Army plans to reinstate the program.

Question. What is the effect of cancelling this program on other Free Electron programs like the Medical FEL?

Answer. The Medical FEL program is not an Army program. It is an Office of the Secretary of Defense program managed by the Office of Naval Research. However, the cancellation of the Army program will likely have a serious, negative impact on the Medical FEL program.

Question. What dual-use applications does the FEL program have?

Answer. Applications of a tunable FEL include surgical instruments; possible use as cancer therapy; medical imaging; photolithography; industrial chemistry and physical phenomena; advanced spectroscopy; and, energy transfer between distant points.

LONGBOW—COMANCHE

Question. Longbow is a development and acquisition program for an air/ground targeting radar capable of being used day or night in adverse weather and with battlefield obscurants. The Longbow System will be developed for integration into the Apache attack helicopter and the Comanche armed reconnaissance helicopter.

Approximately $44.4 million was appropriated last year for integrating Longbow into the Comanche. It appears that there are no funds requested for the effort in Fiscal Year (FY) 1994. Was the effort concluded last year? If not, how much and where is the fiscal year 1994 effort funded?

Answer. The Longbow Fire Control Radar (FCR) integration effort is continuing and is funded in FY94. The initial Longbow funding was $11 million in FY93 which was identified in Program Element (PE) 0604223A Project D397. Based on restructure directions from OSD, the Longbow FCR system will be an integral part of Comanche (PE 0604223A Project D327) after FY93; thus, Project D397 will no longer be identified as a separate project beginning in FY94. In keeping with the integrated weapon system design concept, scope of work associated with Longbow unique efforts in FY94, which include de-rotation unit design, shroud modification and integration testing, will cost approximately $6M.

LONGBOW-APACHE

Question. Due to a potential Apache production line gap, the Committee understands that the Army is evaluating whether to accelerate the Longbow-Apache Research and Development (R&D) program. Please explain the Army's plan for the Longbow–Apache.

Answer. The Army had considered, but does not intend to, accelerate the Engineering Manufacturing Development (EMD) phase of the Longbow-Apache program. There are two reasons for this; 1) acceleration of the R&D effort would induce unnecessary concurrency into the EMD phase which contradicts current policy; 2) the remaining effort required in this phase does not lend itself to any acceleration at this time. Production of Apache Longbow could begin a year earlier (FY95), but would require $139 million of long lead funding in FY94 not currently requested in the President's Budget.

Question. The Committee understands that the pertinent milestones for the Longbow-Apache program have been delayed one year? Is that correct and why?

Answer. As a result of the restructuring of the program in June of 1992, all of the remaining program milestones have been delayed, as reflected in the revised Acquisition Program Baseline that is currently being staffed at the Department of Defense level. This decision, which enabled the retention of the Longbow Apache program while remaining within the Army Total Obligation Authority, requires slipping long lead funding for production from FY94 to FY95. This change required rescheduling major milestones. This restructured Longbow Apache program also supports extensive modernization initiatives culminating in a final, firm, commitment by the Army to support modernization of the entire Apache fleet to a common configuration. This plan will apply operational improvements and reliability upgrades to the entire 811 AH-64A Apache fleet (to the AH-64A+configuration). Subsequently, under the integrated Longbow Apache program, 227 of these Apaches will be remanufactured to the Longbow Apache configuration (AH-64D) with the remaining fleet being upgraded to a new, modernized "baseline" configuration (AH-64C). This "baseline" AH-64C, is provisioned for and, becomes the AH-64D Longbow Apache with the addition of the fire control radar and the up-rated 701C engine.

Question. If the Longbow-Apache Program is slipping, how can the Army justify accelerating the R&D program?

Answer. The Army does not intend to accelerate the Longbow R&D program.

Question. The General Accounting Office issued a report in February 1993 which concluded that effective subcontractor oversight is lacking in the Longbow-Apache program and needs to be corrected prior to production. General Forster, are you aware of this report and do you agree with its assessments? Why?

Answer. The fact that there have been problems with subcontractor management within McDonnell Douglas Helicopter Company has been recognized and continues to concern the Army. We have been addressing this issue at the highest level of the McDonnell Douglas Corporation for some time. The Defense Plant Representative Office (DPRO) has initiated a 'Team Apache' (both Government and contractor representatives) Process Action Team which has put in place a plan to correct this situation. Although we might disagree with some of the specifics of the GAO report itself, we agree that this is a systemic problem and we intend to correct the problem before we a commit to Longbow production in 1995.

Question. What is the Army doing to solve this problem?

Answer. The DPRO in Mesa, Arizona has hosted the first Team Apache Process Action Team to address this issue. They, the DPRO, project that they will have a draft response to this report prepared for submission by the end of May 1993.

Question. If there are oversight problems in the Longbow-Apache program, how can the Army justify accelerating the R&D program?

Answer. The Army does not intend to accelerate the Longbow R&D program.

LONGBOW-HELLFIRE

Question. The fiscal year (FY) 1994 budget requests $107.4 million for the Longbow-Hellfire program. Last year, according to a briefing chart, only $50.5 million was to be requested for this program in fiscal year 1994. Describe this program and explain why such a large increase is being requested.

Answer. Longbow Hellfire is part of the overall Longbow Apache program. Longbow Apache consists of the AH–64D helicopter, the Fire Control Radar (FCR), and the Longbow Hellfire missile. The Longbow Hellfire missile is a fire-and-forget, air-to-ground missile system used to defeat armored vehicles and other individual hardpoint targets. Longbow Hellfire maximizes the ability of Apache to operate in adverse weather and dramatically increases aircraft survivability. The missile configuration was developed with the capability for modular seeker replacements. Longbow Hellfire is in engineering and manufacturing development and uses a radar frequency seeker on the existing Hellfire II bus. Defense Acquisition Executive Summary review in June 92 resulted in an Aug 92 Army Special Program Review (SPR). Subjects of concern were the transceiver, Project Manager (PM) revised program and contract modifications, and unit costs and procurement funding. Results of the SPR (with OSD concurrence) established four incremental milestones to monitor transceiver progress, supported the PM revised plan, increased RDTE funding appropriately, and provided for procurement of 13,311 vice 10,896 missiles. Transceiver co-development is on track, the first incremental milestone was met in Nov 92 and the second milestone was met in Apr 93.

FY94 request is for $107.339 million. The $56.9 million increase in FY94 from that anticipated last year is the result of the Aug 92 SPR. The Army SPR realigned the missile schedule to match the FCR and aircraft schedules. Army increased funding for the missile seeker for: risk reduction, test schedule realignment, transceiver technical and cost problems, increased hardware-in-the-loop simulation requirements, increased test costs by external agencies (Army Research Laboratory, Army Material Systems Analysis Agency), and contractor engineering hour cost increase.

Question. This program appears to be a new start in fiscal year (FY) 1994. How much was requested in what Program Element (PE) in previous fiscal years?

Answer. Longbow Hellfire is not a new start. It was not moved to the Longbow PE; development is part of the Longbow program (PE 6.48.16). Longbow Hellfire seeker (project code DC13) and the Fire Control Radar (FCR) were in the Longbow-Engineering Development (ED) line (PE 6.48.16.A—DC27) before FY94.

Longbow-Hellfire

	Millions
FY91	61.2
FY92	98.7
FY93	81.0

Question. Explain what was accomplished with those funds and why the program was moved to the Longbow program element.

Answer. Fiscal year (FY) 1993 Funding bought: Critical Design Review, Component/Engineering Models and testing, Prototype

Guidance Sections and testing, Tactical Guidance Sections/Launchers and testing, Tower Tests, and Flight Test Hardware.

Longbow Hellfire did not recently move to the Longbow program element (PE). In the FY94 President's Budget, the Longbow program consists of three RDTE sub-elements (Aircraft, Fire Control Radar (FCR), and Missile):

Longbow RDTE—PE #0604816

	Millions
FY94:	
Aircraft	88.143
FCR	82.472
Missile	107.339
Total	277.954

FY94 funds pay for continued development of the Longbow system. Some of the key events for Longbow are: Longbow System Long Lead Item In-Process Review will be held in Oct 94; Training for Force Development, Test and Experimentation (FDTE) starts 4th Quarter (Qtr) 94; FDTE starts in 1st Qtr 95; Last Aircraft prototype delivery Apr 94 (Total 6 Aircraft; 4 AH-64D,2 AH-64C); Missile begins flight testing in FY94 (captive flights, rail flights (12), and helicopter flights (24)); and the Aircraft Improved Digital Modem testing starts Dec 93.

LONGBOW PROGRAM

Question. For the record, provide costs to complete R&D and total costs of each of the Longbow programs.

Answer.

Longbow Apache: R&D to complete (FY94 to complete)—$344.2 million.

Total cost (RDT&E)—$6.369 billion.

Longbow Missile: R&D to complete (FY94 to complete)—$142.3 million.

Total cost—$3.159 billion.

AIR DEFENSE SYSTEMS

Question. The Committee remains concerned about the Army's inability to field air defense systems. Last year, the Congress appropriated an additional $15 million for two programs. It appears that the Army's plan to utilize these funds is for more and more studies and not getting something into the field.

Approximately $7.8 million was appropriated for the Army to restructure (not study) the growth options of the Bradley Stinger Fighting Vehicle (BSFV). These funds were to immediately review the cost and operational effectiveness of mounting existing air defense turrets on the Bradley Fighting Vehicle (BFV). The Army's plan was to propose a 20-month study to address the issue. Why will this study take so long and what do you expect it to accomplish?

Answer. The 20-month study provides an efficient means to position the BSFV program for entry into Engineering and Manufacturing Development. The times and efforts that comprise the 20 months include:

8 months—Obtain data/set requirements for an air defense system from the USMC/Army; Prepare and release of Request for Proposal; evaluate the responses; and award three contracts.

9 months—Contractors develop/submit turret simulation; Army verify/validate the simulation, incorporate the designs into Battlefield Interactive Simulation, and conduct a shoot-off.

3 months—Evaluation of designs/select the best value.

Question. The Light Armored Vehicle-Air Defense (LAV–AD) turret appears to be a leading candidate for adaption to the Bradley Stinger Fighting Vehicle. What is the status of the LAV–AD program and what is the Marine Corps participation in the Army study?

Answer. The USMC LAV–AD program is in the Engineering and Manufacturing Development (EMD) phase. The Marine Corps is one of the agencies that will provide input/data to develop and validate the simulation for use in evaluating the various turret candidates.

Question. What percentage of the funds will be used for the study? What else does the Army expect to accomplish with the $7.8 million?

Answer. 100% of the funds will be used for the evaluation. No other efforts will be accomplished with these funds. After the evaluation, and selection of a turret, the program will be ready to enter Engineering and Manufacturing Development.

Question. For the record, provide Fiscal Year (FY) 1994 and outyear costs to complete this program.

Answer. Presently no FY94 and outyear funds are programmed. To field 267 (procurement objective) Bradley Stinger Fighting Vehicles with upgraded turrets, will require: $13 million in FY94 and $30 million in FY95 for research and development; and $500 million from FY95–99 for procurement.

Question. In addition, $7.8 million was appropriated for the Army to perform a review with Marine Corps participation of candidate missiles for an adjunct or complementary missile to Stinger on the Avenger, Bradley and Light Armored Vehicle-Air Defense (LAV–AD) air defense systems. Here again the Army proposes to conduct a 14-month study. Why will this study take so long and what do you expect it to accomplish?

Answer. Fourteen months is required to perform the necessary review of potential candidates and gather/validate, through lab and field tests, the necessary data to perform the simulation based operational effectiveness analyses of the chosen candidates. The study will identify the best complementary missile to Stinger for consideration for further development.

Question. What percentage of the funds will be used for the study? What else does the Army expect to accomplish with the $7.8 million?

Answer. One hundred percent. The $7.8 million is for the study only.

Question. Why hasn't the Army incorporated a more comprehensive approach, including live-fire testing, for that time and money?

Answer. The Army has not precluded the possibility of live-fire data being utilized as part of the database. However, the cost of live firings would be beyond the scope of the $7.8 million, and thus the Army did not dwell on the live-fire aspect of the test. If a candidate is chosen for which live fire data can be obtained economically, then it would be incorporated.

Question. Has the Army evaluated a Shorts/Boeing proposal to test Starstreak on Avenger, and what it would cost for a thorough evaluation of Starstreak as a complementary missile candidate?

Answer. The Army has reviewed the Shorts/Boeing proposal. There is enough Starstreak data available for its incorporation into an operational effectiveness analyses. Additional Starstreak live fire test data are not required. The Army has not established the cost required for a live fire test of Starstreak on Avenger.

Question. How are USMC requirements and applications being addressed in this effort?

Answer. USMC requirements and applications have been fully incorporated into the study plan. Full USMC participation is required in developing a list of candidate systems, selection of final candidates for evaluation, and preparing and issuing the staff report at the conclusion of the evaluation.

Question. Are there any non-development items or off-the-shelf solutions available in the near term to solve Stinger's inability to engage stand-off helicopters?

Answer. All previous market surveys of potential short range air defense candidate systems have not indicated a full off-the-shelf NDI solution for the complementary missile to the Stinger requirement. Some missiles and alternate guidance concepts offer the potential for significantly improved capability against the rotary wing in clutter threat. But, no fully integrated weapon system currently exists.

Question. For the record, provide fiscal year 1994 and outyear costs to complete this program.

Answer. The study will be completed in June 1994. There is no program planned beyond the study at this time.

Question. What is the Army's strategy for fielding air defense systems in the near term?

Answer. The Forward Area Air Defense System (FAADS) Command and Control will be fielded in its first division in the 4th Quarter Fiscal Year (FY) 1993. The FAADS is an integrated program of complementary systems to counter the air threat to maneuver forces and is comprised of the following components:

Command, Control and Intelligence. Employs the Army command and control systems hardware and its data distribution system to link FAAD ground based sensors and identification devices with FAAD weapons and commanders.

Line of Sight-Rear. Avenger employing the Stinger missile counters the air threat in the brigade and division rear. Full scale production began in Apr 90, with a five year multi-year contract awarded Feb 92. The Army plans on fielding 1,001 fire units (373, delivered to date).

Non-Line of Sight (NLOS). Deployed in the brigade to counter the masked, stand-off helicopter threat and provide an anti-armor capability. NLOS was terminated Dec 90 due to cost overruns, but has been resurrected. An accelerated acquisition strategy is being developed for a FY99 fielding.

Line of Sight-Forward-Heavy. Deployed with the combined arms team to defeat fixed wing and stand-off line of sight helicopter threats. ADATS was terminated Jan 92. The Bradley Stinger Fighting Vehicle (BSFV), employing Manportable Stinger missiles, is an interim fix until an optimal solution can be resolved. Presently 121 of 267 BSFV have been fielded. The Army is studying modifications to the BSFV to fire Stinger missiles without having to dismount the gunners.

Combined Arms Initiatives (CAI). Will enhance maneuver force self-defense against the helicopter threat. CAI includes: (1) adapting Air-to-Air Stinger for the AH–1, AH–64 and C&D models of the OH–58; (2) a new family of main tank ammunition to provide an anti-helicopter capability; and (3) incorporating an air defense sight reticle to the BFV.

Question. Why is it necessary for the Army to embark on new costly long-term development efforts, such as the Advanced Stinger upgrades and Air-to-Air Missile (ATAM), instead of using the funding to get an air defense system into the field?

Answer. An upgrade to Stinger is a cost effective Complementary Missile solution. The Army is basing this approach on the results of analysis conducted to develop a strategy for equipping the Army with a superior missile capability. It recommended the Stinger Missile be upgraded with a focal plane array (FPA). The FPA solution permits Fire & Forget (desired by the user) and is fully compatible with existing launchers, all of which Starstreak does not provide. A Stinger upgraded with a FPA eliminates the Stinger's known deficiencies. A minimal investment for developing and retrofitting existing Stinger with a FPA Seeker will keep the Army's $4 billion investment in missiles and launcher hardware viable. The analysis estimated that it would cost $456 million to procure 5,000 Starstreak missiles. The cost of developing, procuring and integrating new launchers, and fire control onto existing platforms was not specifically addressed, but may exceed $1 billion. The Stinger Complementary Missile Study is reviewing any missile candidate which might provide a potentially more cost effective solution.

[Clerk's note.—End of questions submitted by Mr. Hefner. Questions submitted by Mr. Young and the answers thereto follow:]

X-ROD PROGRAM

Question. General, one of the heroes of Desert Storm was the Abrams Tank and its ability to find and destroy enemy tanks outside of their range. The threat is believed to be expanding its range and one of the future programs which was transitioning from the Advanced Research Projects Agency (ARPA) to the Army was the Enhanced Kinetic Energy Weapon (X-Rod), a millimeter wave guided projectile with increased range and lethality. Last year, this committee provided funding to continue this effort based on favorable testimony relating to its future potential. We have recently learned, however, that ARPA has elected not to fund X-Rod in fiscal year (FY) 94 and FY95 although the Army was prepared to assume funding responsibility in FY96. We also understand that part of ARPA's rationale was that X-Rod was a competing technology with another weapon program called Smart, Target Activated, Fire and Forget (STAFF). It had been our understanding that X-Rod and STAFF were complimenting rather than competing technologies. Could you comment on the aspect of competing versus complimentary?

Answer. A competitive situation would occur if both weapon systems could be used interchangeably and are intended to be used in the same tactical battlefield scenario. On the other hand, complimentary weapons systems may be considered as those designed for different tactical applications which support the overall goal, in this case, of defeating enemy armor at long range. As a top attack munition, STAFF is especially useful against stationary targets which are dug in or in defilade, where the enemy is in a defensive posture. As an autonomous, guide-to-hit, horizontal attack munition, the utility of the X-Rod is a defensive posture. As an autonomous, guide-to-hit, horizontal attack munition, the utility of the X-Rod is against maneuvering, exposed targets. Thus, top attack and horizontal attack munitions have a synergistic effect on the battlefield by permitting long range engagements against targets in either offensive or defensive scenarios.

Question. What is your opinion as to whether or not X-Rod should be continued?

Answer. X-Rod offers potential cost effective applications of its high-G launch, guidance and control, and propulsion technologies to a variety of munitions, such as, tank and air defense munitions. The Army is interested in continuing the development of the X-Rod technologies under the Balanced Technology Initiative program at ARPA through FY95. If the demonstrations by ARPA are successfully completed in FY94 and FY95, subject to an Army decision on full-up development, the Army could begin funding in FY96.

JAVELIN PROGRAM

Question. Another anti-tank system is the Javelin which is a man-portable system with fire-and-forget technology and twice the target acquisition and engagement range of the Dragon it replaces. You are scheduled to complete development and begin limited production in 1994. How is that program progressing?

Answer. The Javelin program is now in the 46th month of a 54 month Engineering and Manufacturing Development (EMD) phase and is tracking close to schedule. The technical problems that plagued the program in the past have been solved. The Focal Plane Array has been particularly successful, with the Hughes Santa Barbara Research Center exceeding both the performance specification and yield expectations. Although the remaining schedule is very tight, the Army is confident it can complete EMD generally on schedule. Currently, the program is undergoing Preproduction Qualification Test flight testing and system level environmental qualification. Force Development Test and Experimentation at Fort Benning, GA has progressed very well and will be complete by the end of April, 1993. Both the Dirty Battlefield Test at Redstone Arsenal, AL and the Portability/Mobility Test at the Human Engineering Lab are ongoing. Technical and User testing will begin in June, 1993. All this is leading to the start of Initial Operational Test and Evaluation in September, 1993. The Army hopes to award a Long Lead Time Items contract in June, 1993, and the Low Rate Initial Production I (LRIP I) contract in May, 1994.

Question. Is there any reason not to proceed with limited production?

Answer. At this time, there is no reason why the Army should not award the LRIP I contract in May, 1994.

PATRIOT ADVANCED CAPABILITY-3 (PAC-3)

Question. The next step in development of the PATRIOT is the PAC-3. Even after its performance in Desert Strom, the critics still are claiming that it did not perform as advertised. Can you tell us what your current assessment of the PATRIOT's capability is and what is planned in this upgrade?

Answer. The Army's assessment of PATRIOT performance in Desert Storm remains unchanged since the April 1992 Congressional Hearings. PATRIOT achieved over 70 percent success in Saudi Arabia and over 40 percent in Israel. PATRIOT was a success in Operation Desert Storm. Throughout the war, PATRIOT protected the lodgment area, provided uninterrupted use of strike airfields and sustaining ports, protected breaching operations, and gave commanders the freedom to maneuver their forces. In Israel PATRIOT's new mission was population protection. Strategically, by protecting the Israeli population, PATRIOT provided the Israeli government a viable option to stay out of the war. The Army is focusing its attention on PATRIOT's improvement for the future. The PAC-2 upgrade, used in Operation Desert Storm, enabled limited asset TBM defense for a footprint beyond the battery self protection capability. This was accomplished via an improved fuze and warhead to increase missile kill probability. The PAC-3 upgrades will improve performance to the 90 percent level with the defended footprint expanded to four times the PAC-2 footprint. PATRIOT Advanced Capability, PAC-3, is a total system performance improvement capability designed to counter the current and evolving, more stressing TBM and air breathing threats. The program includes improvements to the radar, launcher, generator, computer, communications, command and control, target identification, remote launch, emplacement enhancements, and a new missile.

BREAST CANCER RESEARCH

Question. The Appropriations Conferees provided $210 million for breast cancer research. What is the status of this funding and the schedule for executing this research program? Has the Defense Department budgeted any funds for breast cancer research in fiscal year (FY) 1994?

Answer. The Army Medical Research and Development Command (MRDC) has consulted extensively with government and nongovernment groups concerned with the disposition of the funds. The Command has determined that no simple consensus exists on an appropriate investment strategy for the purpose. The Command has sought recommendations from the Institute of Medicine (IOM) of the National Academy of Sciences. The IOM has convened a knowledgeable, impartial panel which reviewed the subject of breast cancer and current research on it, conducted public hearings, and recommended both an investment strategy and a peer review mechanism in its report submitted on 30 April 1993. The

Army anticipates starting implementation of the recommendations in May 1993. The Defense Department has not budgeted any funds for breast cancer research in fiscal year 1994.

INFLATABLE INTRAVENOUS MEMBRANE OXYGENATOR

Question. The Appropriations conferees provided $1 million for an inflatable intravenous membrane oxygenator research program. What is the status of this funding?

Answer. The fiscal year (FY) 1993 House Appropriations Committee (HAC) Report recommended an increase of $1 million only for the Army to begin working with private sector experts to research and develop an inflatable intravenous membrane oxygenator. Senate Appropriations Committee (SAC) and Joint Conference were both silent, but provided $1 million. The Department of Defense Comptroller initiated release of these funds to Army on 15 April 1993. The Army plans to execute this funding in accordance with the U.S. Army Medical Research and Development Command Broad Agency Announcement. This document solicits research ideas from educational institutions, nonprofit organizations, and private industry for FY93 and FY94.

ACQUIRED IMMUNE DEFICIENCY SYNDROME (AIDS)

Question. The Appropriations Conferees provided $20 million for GP–160 vaccine trials. Press accounts report that the Administration has decided to transfer this Defense funding to the National Institutes of Health (NIH) for other AIDS vaccine trials. Is this accurate? Is the Department of Defense (DoD) violating our appropriations law by not performing the GP–160 vaccine trials? Has Congress been notified of this program modifications?

Answer. Under terms of an agreement, $20 million provided to DoD will be transferred from DoD to the Department of Health and Human Services (DHHS). The Army has initiated transfer of the referenced funds to the DHHS for conduct of the clinical trial called for in the fiscal year (FY) 1993 DoD Appropriations Act. The NIH will be responsible for the design and execution of a large scale, phase III clinical investigation among HIV-infected patient populations, consistent with the legislation. This agreement was reached in discussion with Senator Bennett Johnson. The transfer of funds is being made under the Authority of the Economy Act (Section 1535 of Title 31, United States Code), which authorizes agreements between Federal Agencies to carry out government activities in the most efficacious manner. All legal requirements applicable to DoD's use of the funds will continue to apply in connection with NIH's conduct of the clinical investigation. Thus, the Economy Act transfer will be consistent with the requirements of the FY93 Appropriations Act.

CONSOLIDATION OF THE SERVICES' MEDICAL RESEARCH PROGRAMS

Question. The President's budget continues to allow the services to perform their own medical research and did not consolidate this funding in the Defense Health Program budget. Does it make sense to allow each Service to have its own medical research program?

Answer. Yes. Base Realignment and Closure (BRAC) 91 actions under the Tri-Service Project Reliance Study include the closure of 3 of the 9 Army Medical Research Laboratories and collocation of the services blood research, environmental and occupational toxicology research, combat dentistry, and infectious disease programs. This effort results in maximum efficiencies in these research areas while allowing flexibility to support efforts to satisfy service unique requirements. Thus, there is no advantage in further consolidations.

[Clerk's note.—End of questions submitted by Mr. Young. Committee questions for the record and the answers thereto follow:]

BRADLEY FIGHTING VEHICLE (BFV) SYSTEM

Question. The fiscal year (FY) 1994 request includes a new start of $46 million to begin technology integration to modernize the Bradley Fighting Vehicle to an A3 configuration. Explain the reason for this upgrade and how it will benefit the Army.

Answer. To achieve land force dominance and ensure overmatching technological capabilities, the Army is initiating a continuous modernization program of its Bradley Fighting Vehicles. A key element of this modernization program is the Bradley A3 which will leverage the horizontal technology approach to modernization by integrating digital and combat identification capabilities, and infrared sensors. Specifically, the A3 will provide digitized command and control systems, increased lethality through improved optics, fire control systems and target acquisition, and enhanced survivability through active and passive defensive measures. The A3 Bradley will be fielded in the Continental United States Contingency Force to provide operational compatibility with the M1A2 Abrams tank.

Question. What is the estimated cost to complete the Research and Development (R&D) on this upgrade and is it currently or planned to be fully funded in future years budget requests?

Answer. The estimated cost to complete R&D on this upgrade is $365.7 million in FY94–98.

FY94	46.0
FY95	110.3
FY96	110.4
FY97	80.3
FY98	18.7
Total	365.7

The Army plans to include this in future budgets.

Question. For the record, provide a detailed breakout of the $46 million. Include fiscal year 1994 costs, R&D costs to complete, and total cost for each item.

Answer.

Description	FY94	To complete	Total
Core electronics	30.6	56.1	86.7
Survivability improvements	0.9	1.2	2.1
Improved target acquisition	1.2	146.9	148.1
Vehicle integration	5.9	10.7	16.6
Other RDT&E support	7.4	104.8	112.2

Description	FY94	To complete	Total
Total RDT&E costs	46.0	319.7	365.7

RECOVERY VEHICLE IMPROVEMENT PROGRAM

Question. The fiscal year (FY) 1994 request for the Recovery vehicle Improvement Program is $11.4 million. This program is intended to replace and/or augment the existing M88A1 in the recovery of damaged heavy combat vehicles on the battlefield, to include the M1A1 series tanks and future heavy combat vehicles. Last year, the Milestone III (production) decision was scheduled to be made in October 1993. This year's request indicates that the date for Milestone III has been changed to June 1995. Why has this program slipped two years?

Answer. The $11.4 million requested for FY94 supports the program's research and development effort. The Milestone III decision is being delayed to accommodate the Army's decision to withdraw $16.8 million of Procurement funds for FY94. Funding constraints in the FY94 budget caused a re-evaluation of the funding priority of the IRV along with many other programs. Based on this re-evaluation the Army determined that production of the IRV could be delayed to FY95.

Question. What is different from what was proposed last year to cause such a slippage?

Answer. In the President Bush budget, $16.8 million of Procurement funding was requested for FY94. During the recent adjustment of the FY94 budget, the Army decremented the Improved Recovery Vehicle program. Consequently, no procurement funds are requested in the current FY94 budget. The President Bush budget also included an $11.8 million research and development (R&D) request. The adjusted FY94 budget requests $11.4 million.

Question. What additional work will now be done in the R&D program?

Answer. Pilot test vehicles will be procured with the $11.4 million of R&D funds in support of Production Qualification Tests.

Question. Last year, the estimate to complete the R&D on this program was $16.7 million. Due to the stretch out of this R&D program, what is the current cost to complete R&D?

Answer. The current cost to complete the R&D effort has not changed. The reduction in FY94 Procurement funding and production slip has not changed the R&D requirement.

Question. When does the Army plan to field an Improved Recovery Vehicle?

Answer. Based on the current funding level, the First Unit Equipped date is during the fourth quarter of FY96.

ADVANCED COMMAND AND CONTROL VEHICLE

Question. In fiscal year (FY) 1993, Congress appropriated $21.6 million for the Future Command and Control Vehicle (C2V), which is an armored vehicle used to command forces on the battlefield. Describe how these funds are being utilized?

Answer. These funds are being utilized for engineering design efforts, purchase of long lead items for pre-production prototypes, a brassboard vehicle and testing, mission module equipment, and in-house support for management of the program.

Question. A briefing chart provided the Committee only shows $6.6 million as the FY93 program. What happened to the other $15 million?

Answer. The FY93 appropriation for the C2V program is $21.6 million. We have obligated $6.6 million to date. We recently released the remaining funds based on a successful program review by the office of the Secretary of Defense. We expect obligation of the remaining $15 million by the end of the FY.

Question. The FY94 budget requests $8.7 million in a program element entitled Advanced C2V. What is to be accomplished with these funds?

Answer. The FY94 program will complete the pre-production of prototypes and initiate testing of those vehicles.

Question. One of the Lessons Learned in Operation Desert Storm was that the M577A2 Command and Control Vehicles (C2V) could not maintain pace with the maneuver force and lacked mobility, reliability and survivability. Given there are major deficiencies, why has the Army decided to not use $15 million of the fiscal year (FY) 1993 funds and only request $8.7 in FY94?

Answer. The Army does intend to use the remaining $15 million FY93 funds. The funds were withheld within the Army until program issues were successfully resolved. These funds have been released and the program is proceeding. The FY94 $8.7 million reflects a program stretch due to delays in the development of operational requirements documents.

Question. Does the Army not believe that an Advanced C2V is immediately required?

Answer. The C2V is a key component of the Army's plan to digitize the battlefield. Notwithstanding the funding constraints which drive the current FY99 fielding, the Army is exploring options to accelerate the system's schedule.

Question. At the funding level proposed by the Army to date, when will research and development (R&D) be completed and when will the new vehicles enter the force?

Answer. The proposed program will complete R&D in FY97 and the first unit will receive its vehicles in FY99.

LIGHT TACTICAL WHEELED VEHICLES

Question. The fiscal year 1994 budget requires $2.1 million as a new start Light Tactical Wheeled Vehicles. Describe this program.

Answer. The $2.1 million is for an non-developmental item (NDI) prototype competition for a Armored Security Vehicle (ASV) that meets the increased ballistic and NBC protection required by a Military Police (MP) three man team. Specifically, the dollars support the release of the Request for Proposals, the Source Selection Evaluation Board, and the prototype award contract.

Question. What funding will be required in future fiscal years for this program? To complete R&D?

Answer. In FY95 and FY96, we are planning to spend $3.5 million and $.9 million respectively. Total program is $6.5 million.

Question. What is the procurement profile for this program?

Answer. The procurement profile is as follows: FY96 $10.3 million, FY97 $9.6 million, FY98 $9.4 million and FY99 $7.0 million.

Question. A news article states that the Army plans an international competition in September for a $40 million contract to buy 95 armored cars for military police units. Is that correct?

Answer. The 95 armored vehicles and $40 million figures are about right. The market survey looked at both domestic and foreign candidate vehicles.

Question. September is in fiscal year 1993. How can the Army award a contract using fiscal year 1994 funds in fiscal year 1993?

Answer. The Army has no plans to award a contract in September 1993, we do plan to release the Request for Proposals upon release of the fiscal year 1994 program.

Question. What funds are being used in fiscal year 1993 to prepare a draft RFP for this new start in fiscal year 1994? When will a new start reprogramming be submitted to the Committee?

Answer. The small, fiscal year 1993 effort is supported on a part time basis out of several programs. The Army does not plan to submit a new start reprogramming to the Committee.

Question. Is the Army using R&D funds to procure vehicles? If so, why?

Answer. The Army plans to use R&D funds to procure and test prototype armored vehicles in a run off competition to support the down selection process. In addition, the Army is encouraging the use of common power trains to existing systems in the inventory. This may cause some additional integration work by potential bidders.

Question. What would be the estimated unit cost of these vehicles?

Answer. The estimated unit cost (hardware) is $350 thousand.

Question. What is the amount to complete R&D costs and the total costs for this program?

Answer. The amount to complete R&D costs is $6.5 million and the total costs are $42.7 million.

Question. The news article states that the Army has examined a number of vehicles now on the market, most of them by foreign vendors. Has the Army examined the Marine Corps' Light Armored Vehicle (LAV) for this mission?

Answer. The LAV was part of the market survey, however, it exceeds the requirements needed by the MPs and costs over $1 million. The manufacturer (GM–Canada) of the LAV will be invited to compete for the ASV award.

Question. If these vehicles are already on the commercial market, why isn't this program a non-developmental item funded in a procurement appropriation?

Answer. Due to the potential integration work on armor and powertrain requirements and extensive prototype testing to support the procurement award down selection, the Army determined that this effort was best funded in the RDT&E Appropriation.

Question. Are other services participating in this program? If so, which ones and to what extent? If not why isn't this a joint program?

Answer. The USAF has expressed interest in this program in fulfilling their requirements for a "multi-role" vehicle. We are incorporating their specifications in the Army's draft Request for Proposals. At this time the USAF has made no final decisions. We will continue to work closely with them on this effort.

Question. The Army's justification material states that this is an Armored Security Vehicle (ASV) to provide improved ballistic protection and NBC protection to the military police who currently use the High Mobility Multipurpose Wheeled Vehicle (HMMWV). How can this vehicle be considered "light" if ballistic and NBC protection are requirements?

Answer. The Army has three R&D program elements for tactical wheeled vehicles: heavy, medium and light. An administrative decision placed the ASV in the "light" program element; it could just have easily been placed in the "medium" line.

Question. Why can't the armored "heavy HMMWV" satisfy the requirement?

Answer. At this time the Army does not have an armored "heavy HMMWV". The Army has the Heavy HMMWV (HHV) with an increased payload of 4400 pounds (M1097) and HMMWVs with supplemental armor protection (M1025/M1026/M1043/M1044). The current armor package available to HMMWV does not meet the MPs required ballistic protection. Also, the HHV does not meet the payload specified for the ASV.

INTER-VEHICULAR INFORMATION SYSTEM (IVIS)

Question. Last year, Congress appropriated $9 million to demonstrate the application of the Inter-Vehicular Information System (IVIS) to aid in the reduction of fratricide on the modern battlefield. How will the funds be used?

Answer. On December 14, 1992, the Army provided a letter to Congress outlining a two phase plan to demonstrate the application of IVIS. Phase I was a technical demonstration of digital tactical communications using current Abrams M1A2 IVIS hardware and software modified for use in a Bradley, Tactical Operations Center (TOC), and mortar Fire Direction Center. The IVIS software was modified in to interface with the Improved Data Modem (IDM) and fire support systems. Digitally connected weapons systems participating in the Phase I demonstration included five M1A2's, one modified M3 Bradley, three M106 mortar carriers, four M109 Howitzers, and one OH–58D Kiowa Warrior. The demonstration was conducted on March 25, 1993 at Ft. Knox, Kentucky. The cost for Phase I of the IVIS demonstration program was approximately $2.6 million.

Phase II will develop follow-on improvements in IVIS hardware and software. Specific tasks that are planned in Phase II include improving the M1A2 functionality based on user feedback, modifications to permit interface of the M1A2 IVIS with other existing and future Command and Control (C2) systems, and providing enhancements to the functionality of the IVIS in the M1A2 and

"IVIS like" capability in other platforms such as the Bradley Fighting Vehicle (BFV) and command and control vehicles by adding Administration/Logistics (Admin/Log), Combat Identification, and TOC unique functions. Phase II will proceed from the March 1993 demonstration and will culminate with an excursion to test modifications of hardware and software on applicable systems in by the end of fiscal year (FY) 1994.

Question. The Committee understands that the IVIS/ATHS (Airborne Target Handoff System) demonstration using the M1, BFV, OH-58D in March was quite successful. Please describe the demonstration and its results.

Answer. The demonstration was conducted as a live fire, tactical exercise by a Combined Arms Task Force on March 25, 1993 at Ft. Knox, Kentucky. The actual digital demonstration of the IVIS capability was executed in the Abrams, Bradley, and a Kiowa Warrior scout helicopter. The exercise included Armor, Infantry, Artillery, Engineers, and Aviation units executing a scenario beginning with a tactical exercise in a maneuver area culminating with a combined arms live fire exercise.

The Phase I demonstration produced three clear results. First, situational awareness was improved within the task force. Each vehicle/aircraft in the modified IVIS/IDM network maintained updated positions of other vehicle/aircraft in the same network. Second, target handoff capability was demonstrated by the ground and airborne weapon systems' ability to identify targets and hand them off to each other at will (IVIS and IDM). Finally, command and control within the task force was improved. Leaders were able to conduct pre-combat planning (prepare and send overlays digitally) and execute a closely synchronized battle with massed fires (in less time and with greater accuracy) while maintaining full awareness of the enemy and friendly vehicles around them.

Phase II of the IVIS demonstration plan will focus on the results and recommendations from the March 25, 1993 technical demonstration of tactical digital communications. Recommended enhancements and capability to be addressed in Phase II include: providing a more robust capability for the M1A2 to identify and display friend and foe vehicles; developing more commonality of data and format; ensuring IVIS is able to interface with existing systems (IDM); and, determining if additional IVIS or "IVIS like" hardware configurations and software modifications should be created to outfit the maneuver battalion with this C2 technology (Tactical Operations Center and Admin/Log Cell).

Question. Why are there no funds included in the fiscal year 1994 request to continue demonstrating the interoperability of using IVIS/ATHS in the field to help reduce instances of fratricide?

Answer. Phase II of the IVIS demonstration will occur between April 1993 and September 1994. The Army estimates that the $6.1 million remaining will fund the balance of the FY93 and FY94 effort. If additional scope of effort is identified during the execution of Phase II, the Army will include Research, Development, Test and Evaluation (RDT&E) funds in the FY95 budget request. Technical solutions to lower echelon interoperability are also being developed under the Combined Arms Command and Control Advanced Technology Demonstrator which is funded under Science and Technology Thrust Five.

Question. IVIS provides digital capability to the M1A2. How does the Army propose to digitize the Bradley Fighting Vehicle (BFV) to make it comparable to the M1A2?

Answer. The Army has funded a Bradley Modernization Program which includes the Core Electronic Architecture to digitize the Bradley. The Bradley, like the M1A2, is a key component of our strategy to digitize the battlefield. The Bradley A3 will include an "IVIS like" capability. The Bradley A3 RDT&E effort will start in FY94 and continue through FY98.

Question. Given the successful results of the demonstration and if future demonstrations show that IVIS is technically responsive, tactically required, and can be extended to other parts of the force, when and how does the Army propose to field it for the rest of the maneuver force? What should be the next vehicle to receive IVIS? What other vehicles should be considered as candidates for IVIS?

Answer. In addition to the Abrams, Bradley, and Paladin, the Army is reviewing the Armored Gun System, Command and Control Vehicle, Heavy Assault Bridge, and the Bridger/Breacher, as candidates for digitization.

Question. Are there any plans to include IVIS in a Combined Arms Team mode during the M1A2 Interoperational Test and Evaluation (IOT&E)?

Answer. The M1A2 IOT&E test plan and scenarios will replicate a Combined Arms Task Force using 18 M1A2 tanks, and three IVIS equipped base stations. An IVIS or "IVIS like" capability for the Bradley, that has been fully integrated and is fully operational, will not be available for the M1A2 IOT&E. Therefore, Bradleys will not participate in the M1A2 IOT&E.

SCIENCE AND TECHNOLOGY PROGRAMS

Question. Last year, Science and Technology (S&T) Thrusts were emphasized as a major part of the new Office of the Secretary of Defense strategy to conduct technology demonstrations, continue to exploit technology for new purposes, and involve the user in the development process. Mr. Singley, does the Army continue to support these efforts and why?

Answer. The Army is enthusiastic about the S&T thrusts as a way to focus advanced technology demonstration programs on solving problems associated with converting to a Continental United States-based power projection force in a time of scarce resources. The Army has established a task force, the Joint Precision Strike Demonstration Task Force, focused on precision strike and the Army's contribution to deep fires and deep attack to improve ground, joint and theater commanders' capabilities. The Army program has as its mission to improve current precision strike capabilities by integrating emerging technologies and innovative concepts to reduce the time it takes to locate, identify and kill time critical targets. The program is especially focused on leveraging current capabilities and emerging capabilities in order to save costs, reduce conflicting or redundant efforts, and field a more robust capability in the near term. Horizontal synchronization of all systems required to support precision strikes and the improvement of command, control and communications procedures is being uniquely focused to enhance the Army's already robust precision strike capabilities. The Army program is not, however, only focused on service unique systems and capabilities. It also is working to coordinate with the work and efforts of ARPA, the services, and other DoD organizations. In the case of Thrust 5, there are currently three programs to attack serious Army deficiencies: Advanced Vehicle Technologies to make ground combat vehicles smaller, lighter and more deployable, yet retain their warfighting capabilities; Rapid Force Projection Initiative to improve capabilities of our early deploying, light forces, especially against heavy armor, without sacrificing their air deployability; and 21st Century Land Warrior to provide our dismounted soldiers a capability edge over their adversaries through advanced technologies. All of these are examples of initiatives that respond to the post-Cold War era, where the United States must be prepared to rapidly project power to distant regions for a wide range of contingencies. Through simulations and field demonstrations, both with early user involvement, we will identify technologies and tactics that offer the greatest potential so that the user can better define requirements and make informed choices concerning the product improvements and smaller number of new programs that we anticipate.

Question. Which of the major thrust areas are of primary concern to the Army and how is the Army implementing them?

Answer. The thrust areas of paramount interest to the Army are Thrust 2, Precision Strike, and Thrust 5, Advanced Land Combat. We are also interested in and a major participant in Thrusts 3, 6 and 7, Air Defense, Synthetic Environments, and Technology for Affordability, respectively. Within the precision strike program, the Army will conduct a series of risk and cost reduction demonstrations annually. These demonstrations will focus on incrementally working precision strike problems and inserting new and evolving capabilities as they become available. This approach will allow the Army to conduct demonstrations to determine the best solutions before new systems or capabilities are purchased on a larger scale. We must underscore that what we are trying to do is enhance the Army's existing capabilities to attack precision strike targets at depth. This effort is further focused on the Army contribution to support theater and joint force commanders' capabilities to detect, engage and destroy time critical targets within meaningful timelines. This effort will improve the field commanders' capabilities to accomplish the mission and protect the force. The Army is the lead service for Thrust 5. We are encouraging joint programs to the maximum extent possible, and a general officer level advisory board, co-chaired by the Army and the Marine Corps, provides guidance and facilitates transfer of technology and interoperability among the Services. The Thrust Leader is a senior Army civilian, and the managers of each of the top level demonstrations come from the Army S&T community and will be located at Army Research, Development and Engineering Centers. We also have a very close relationship among the Army S&T community and the Army Training and Doctrine Command's Battle Labs.

Question. For the record, provide a breakout of program element (PE)/project, and funding for each major science and technology thrust of the Army.

Answer. Army funding for the S&T thrusts is shown in the following table.

Title and PE/Project	*FY94 $ millions*
Thrust 2—Precision Strike:	
Joint Precision Strike Demo—0603238A/D177	
TRACTOR HOLE—0603012A/DC24	11.8
TRACTOR HOLE—0603238A/D182	9.5
Thrust 5—Advanced Vehicle Technologies:	
Hit Avoidance—0603005A/D221	10.5
Vehicle Countermeasures—0603270A/DK16	2.1
Vehicle Countermine—0603606A/D608	3.7
Composite Armored Vehicle—0603005A/D440	16.8
Crewman's Associate—0603005A/D497	6.7
Advanced Combat Mobility—0603005A/D441	2.1
Combined Arms Command & Control—0603772A/D101	11.4
Thrust 5—Rapid Force Projection Initiative:	
Light Contingency Vehicle—0603005A/D440	2.1
Advanced Submunition Sensor—0603004A/D43A	1.0
RFPI Simulation—0603313A/D486	8.1
RFPI Integrated Demo—0603313A/D493	1.0
Enhanced Fiber-Optic Guided Missile—0603313A/D496	10.5
Intelligent Minefield—0603606A/D006	2.3
Scout Sensors—0603710A/DK70	8.9
Remote Sentry—0603710A/DK70	3.0
155mm Light Weight Howitzer—0603004A/D43A	.4
Precision Guided Mortar Munition—0603004A/D43A	3.4
Multi-Platform Launcher—0603313A/D493	.4
Thrust 5—21st Century Land Warrior	
Command, Control, Communication, Computer/Intelligence Subsystem—0603772A/D101	.4
Integrated Sight Modules—0603710A/DK70	1.0
Objective Individual Combat Weapon—0603607A/D627	1.8
Generation II Soldier—0603001A/DXXA	2.9

MODELING AND SIMULATION

Question. Last year Congress appropriated $5 million above the budget for Modeling and Simulation technology. Describe how and for what purposes these funds were used.

Answer. Funding supported four main initiatives as follows:

(1) [$3000K] Model and simulation development and demonstrations in support of Louisiana Maneuvers (LAM) activities including: Aggregation/deaggregation of constructive to virtual simulation(s) protocols; Mobilization and deployment modeling; After Action Report Tool modeling; and Rapid Scenario Preparation Unit for Intelligence (RASPUTIN) enhancements for force structure laydown to platoon level with movement scenario generators based on terrain, weather and threat conditions. RASPUTIN provides databases and synchronization of databases for constructive simulations such as Corps Battle Simulation.

(2) [$500K] Broad Agency Announcement (BAA) conducted. Northern Michigan University, Marquette, MI will provide proposal to conduct a research effort in the areas of geographic information, digital mapping and remote sensing. Deliverables will transition to Distributed Interactive Simulation (DIS) programs including Battlefield Distributed Simulation-Develop-

ment and Combined Arms Tactical Trainer and support LAM exercises and applicable.

(3) [$800K] Concept to Production Simulation Demonstration including real time, warfighter in the loop, DIS linked simulators and simulations. Demonstration will include a battalion level combined arms scenario involving ground and air weapon systems (e.g., M1, Comanche, Apache, Bradley and LOSAT.)

(4) [$400K] Demonstration of an advanced command and control (C2) simulation center at the Battle Command Battle Lab, Ft. Leavenworth, KS. C2 simulation center will be networked on the Defense Simulation Internet and participate in LAM exercises.

Question. The fiscal year 1994 budget does not include any funding to continue this program. Why?

Answer. Definition of LAM issues/exercises and related funding are currently being developed and finalized. Battle Lab participation in LAM currently is in formulation stages.

Question. What funding level would be required to continue the efforts started last year?

Answer. $5 million. Funding will initiate Advanced Concepts/Technology (ACT) program in support of TRADOC Battle Labs and LAM exercises. Act key elements include:

Demonstration of advanced concepts/technologies using advanced distributed simulation.

Establishment of early links between warfighter at Battle Lab(s), industry, and government researchers.

BAA issued for industry to respond with advanced concepts and technologies to be simulated, tested and evaluated at the Battle Lab.

Central funding (PE 0602308).

BAA formulation reflecting innovative technology follow-on initiatives keyed to Battle Lab interests.

Serves as "Point of Entry" to Battle Labs for industry and academia.

Question. If funding were not constrained, what additional efforts would be started?

Answer. FY94 efforts would include: Soldier/Battlefield Interface modeling: $3 million; Constructive/Virtual/Live LAM/Battle Labs Demos: $4 million; LAM models enhancements (RASPUTIN, Aggregate Level Standard Protocol, After Action Report, Mobilization/Deployment): $3 million and ACT: $5 million.

ARTILLERY PROPELLANT DEVELOPMENT

Question. Last year, Congress appropriated $10 million to complete the development and operational testing of the 52 caliber cannon system. What is the status of this program?

Answer. With the $10 million appropriated in fiscal year (FY) 1993, the Army initiated a development program for a 52 caliber cannon system. The FY93 funds support development, fabrication and testing of XM297 cannon components; development of a cannon Technical Data Package (TDP); testing of critical technologies related to the gun (including laser ignition) and recoil system;

and demonstration of the cannon assembly. These efforts will be completed during FY93.

Question. Describe the Army's proposed program and indicate funding required by FY.

Answer. Based on operational requirements and affordability, the Army is requesting no funds for this program beyond FY93. However, if continued, the 52 caliber cannon development program would require $10.1 million in FY94 and $8.7 million in FY95. The FY94 effort would include testing and evaluation of the cannon assembly, fabrication of the gun mount and recoil system, and completion of the laser ignition program. The FY95 effort would include testing and integration of the armament components; conducting performance, reliability, and safety assessments; and developing an Armament TDP to initiate design, integration and testing on a weapon system. This three year plan would complete Engineering and Manufacturing Development of the XM297 cannon to a point where it could be integrated into a weapon system for type classification.

Question. On what system does the Army plan to type classify the XM297? When will Research Development Testing and Engineering (RDT&E) be completed on this system and when will it enter the Army inventory?

Answer. At present, the Army has no plans to type classify or field a system with the XM297 cannon.

Question. What percentage of the $10 million has been obligated and expended to date for utilizing the XM297 onto Advanced Field Artillery System (AFAS)?

Answer. None of the developmental work being performed during FY93 is AFAS specific. The XM297 is not the projected armament system for AFAS.

Question. The Congress' main reason for appropriating the $10 million was for near term capability to increase the range and rates of fire of an existing cannon system. Has the Army evaluated retrofitting the XM297 onto the M109 howitzer family as a near term capability? If not, why not? If so, what was the result of this evaluation?

Answer. The Army has conducted a preliminary assessment of the feasibility and value of retrofitting the XM297 cannon on an M109A6 Paladin howitzer. Neither the operational benefits nor the cost justify such a program.

The Army's Modernization Plan for fire support focuses on developing technologies for application on cannon artillery systems to resolve long standing operational deficiencies in accuracy, range and rate of fire, mobility, vulnerability to counterfire, and personnel requirements. The Paladin improves the range and reliability of existing cannon artillery, but does not fully satisfy our range, accuracy, rate of fire, mobility or survivability requirements. Consequently, our long term strategy is to develop the Advanced Field Artillery System, which will provide twice the effectiveness of the Paladin and a reduced crew size.

Question. Provide a funding breakout by fiscal year for type classifying the XM297 on the M109 howitzer family.

Answer. The total Research, Development, Test and Evaluation cost to type classify a "52 caliber Paladin" is:

[In millions of dollars]

First year	$10.9
Second year	17.6
Third year	14.7
Fourth year	10.2
Fifth year	2.9
Total	56.3

XM-982 EXTENDED RANGE ARTILLERY PROJECTILE

Question. Last year, Congress appropriated $3.4 million for development of the XM-982 155mm Extended Range Artillery Projectile. This projectile is to provide the capability to deliver highly effective cargo sub-munitions at extended ranges utilizing existing inventory of howitzers and multiple rocket launcher systems. Why has the Army chosen to ignore Congressional direction?

Answer. Unforeseen funding requirements for Somalia and the relative priority of the XM-982 forced the Army to make the very hard choice of including it on the FY93 reprogramming request.

Question. What can be accomplished with the $3.4 million?

Answer. The $3.4 million could be used to initiate multi-year, incrementally funded design and development contracts for critical technologies (i.e., propulsion, fuzing and metal parts), culminating in a technology demonstration.

Question. What funds are required to complete the pre-engineering manufacturing development (EMD) of this projectile? How much and in what future years?

Answer. Since FY92, the Army has funded exploratory development of components for the XM-982. In addition to the exploratory development funding ($2.0 million in FY93 and $1.0 million in FY94), the Army estimates that $12.9 million is required to complete the pre-EMD phase. Under the most optimistic scenario, work could be completed in early FY95, or if less funds are made available, the schedule would be adjusted accordingly and cost would increase.

Question. Describe the benefit to the Army of continuing the development of this projectile. What additional range and accuracy does the Army envision can be reached when this projectile has completed development?

Answer. This projectile will significantly extend the lethal range and improve our capability to accurately dispense sub-munitions such as the Sense and Destroy Armor (SADARM)). It will be compatible with all fielded and emerging 155mm artillery systems in our inventory. In the best case, with the Advanced Field Artillery System using liquid propellant (LP), it will extend the range to 50 kilometers. A range comparison is shown in the following table.

Projectile	Charge	Maximum range (KM)
M549A1	M203A1	30.0
XM982	M203A1	34.5
XM982	XM230 (Unicharge)	43.0
XM982	XM46 (LP)	50.0

Question. The Committee understands that the Army has tested components of this projectile, but has not fired a full-up round. What type of data can be evaluated by firing a full-up round?

Answer. Firing of full-up rounds will be accomplished with hardware that, while close to design configuration, is not the final design configuration. The data from the preliminary flight tests will be used to refine the design and optimize the projectile aeroballistic performance.

Question. If Congress denies the use of the $3.4 million as a source for the Somalia reprogramming, how would the Army utilize the $3.4 million if no future funding was provided?

Answer. The $3.4 million would be used to provide information on the ability of the initial design to meet safety, transportation, handling, storage, or severe condition requirements, as well as full-up firing and evaluation of the preliminary design concept. This is in contrast to a fully funded pre-EMD program that would demonstrate fixes to the initial design through subsequent firings of redesigned configurations. All of the data obtained through this $3.4 million investment would be available to the Army for future extended range artillery development programs.

Question. How would the Army utilize the funds if Congress appropriates an additional $3.5 in fiscal year 1994? $5 million? $10 million?

Answer. Assuming that the $3.4 million were denied by Congress as a Somalia billpayer and were available for the XM–982, the funding needed to complete the advanced technology development phase is $9.5 million in FY94. If a lesser amount is provided, the advanced technology demonstration work must be extended and costs will increase. If $5 million is provided in FY94, an additional year will be required to complete the advanced technology demonstration phase, and an additional $1.5 million will be added to the total cost. If $3.5 million is provided, an additional two years will be required and the total cost will increase by an estimated $3.0 million.

ADVANCED TANK ARMAMENT SYSTEM (ATAS)

Question. Last year, Congress appropriated $27 million for the Advanced Tank Cannon (ATAC). Total cost envisioned for ATAC last year was $511.7 million. In fiscal year (FY) 1994, ATAC is incorporated into a new program element entitled Advanced Tank Armament System (ATAS). Please explain the difference between ATAC and ATAS.

Answer. The difference between ATAC and ATAS is the name. The scope of work and program objectives are the same. ATAS more accurately describes the effort as a system, not just a cannon, as implied with the name ATAC. ATAS includes improvements in gun, ammunition, fire control and autoloader technologies. When completed in FY99, the Army will have invested approximately $220 million in ATAS research and development (R&D). Integration and technical testing resulting in type classification for M1A2 is estimated at $550–600 million.

Question. Will the $27 million appropriated last year be used as directed by Congress, i.e., (A) initiate type classification on XM291 gun in FY93 and (B) fold XM291 gun into Abrams upgrade as soon as possible? Why? Why not?

Answer. All prior and current ATAS R&D work supports eventual type classification of the XM291 gun on a tank system. Since the XM291 gun is the most mature of the technologies that comprise the ATAS program, only $5 million of the $27 million appropriated for ATAS in FY93 was required to continue gun development. Similarly, out year ATAS funding reflects relatively modest requirements for gun R&D compared with the other efforts. The Army is pursuing XM291 gun development at a pace which will ensure that the entire suite of ATAS capabilities is available for type classification as soon as possible given fiscal realities. Accordingly, the Army intends to complete R&D in FY99, and keep open an option to integrate ATAS as part of a long-term tank modernization program (e.g. "Phase III" Abrams upgrade). Given current funding (R&D) and cost estimates (integration and testing), FY01 is the earliest ATAS will be available for Abrams upgrades. Integration and testing leading to type classification is estimated at 51 months and $550–600 million.

Question. Is moving the Advanced Tank Cannon (ATAC) funds into Advanced Tank Armament System (ATAS) a way of circumventing the direction of Congress?

Answer. No. The decision to change the name from ATAC to ATAS was made prior to the direction of the joint conference language. The name change has no effect on the program's original scope of work.

Question. When all the XM291 be type classified and demonstrated on an M1A2?

Answer. With current funding, safety certification will be completed in fiscal year (FY) 1997. The XM291 gun could be type classified as part of a tank system in FY01.

Question. For the record break out how the $27 million will be utilized.

Answer.

	Million
Gun	$5.0
Ammunition	1.6
Autoloader	.5
Extended Range Gunnery	5.6
Target Acquisition System	4.3
Turret	7.3
Tests	.7
Program Management/Support	2.0
Total	27.0

Question. How will the $5.4 million requested in fiscal year (FY) 1994 be used?

Answer.

	Million
Gun	$0.0
Ammunition	.0
Autoloader	.0
Extended Range Gunnery	1.4
Target Acquisition System	.8
Turret	2.0
Tests	.2

	Million
Program Management/Support	1.0
Total	5.4

Question. What is the estimated cost to complete research and development for Advanced Tank Armament System (ATAS)?

Answer. $164 million from FY94 through FY99.

Question. The Committee understands that $30.8 million is required in FY94 for ATAS rather than the $5.4 million requested in the FY94 budget. What isn't being accomplished at this reduced funding level?

Answer. There will be no work on ammunition, the autoloader or the gun. Minimal effort will be directed toward extended range gunnery, turret and target acquisition system.

[CLERK'S NOTE.—End of questions submitted for the record.]

Mr. MURTHA. Thank you very much, General.

The Committee will recess while we vote, and then we will hear our next set of witnesses. You are excused. Thank you very much.

WEDNESDAY, APRIL 21, 1993.

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, NAVY

WITNESSES

DR. EDWARD C. WHITMAN, SENIOR CIVILIAN OFFICIAL, OFFICE OF THE ASSISTANT SECRETARY OF THE NAVY FOR RESEARCH, DEVELOPMENT AND ACQUISITION

VICE ADM. WILLIAM A. OWENS, USN, DEPUTY CHIEF OF NAVAL OPERATIONS (RESOURCES, WARFARE REQUIREMENTS AND ASSESSMENTS)

LT. GEN. CHARLES C. KRULAK, USMC, COMMANDING GENERAL, MARINE CORPS COMBAT DEVELOPMENT COMMAND

INTRODUCTION

Mr. WILSON. The Committee will come to order. This afternoon the Committee will conduct two hearings: Research, Development, Test and Evaluation, Navy, from approximately 1:30 to 2:30; and Research, Development, Test and Evaluation, Air Force, from approximately 2:30 to 3:30. We plan to stop at 2:30 to change witnesses. Both hearings are conducted in closed session due to security classification of the material to be discussed.

We begin with the Research, Development, Test and Evaluation, Navy appropriation, for which about $9.4 billion is requested for fiscal year 1994.

The Committee is pleased to welcome Dr. Edward C. Whitman, who is the Navy's Senior Civilian Official in the Office of the Assistant Secretary of the Navy for Research, Development, and Acquisition. He is accompanied by Vice Admiral William A. Owens, who is the Deputy Chief of Naval Operations for Resources, Warfare Requirements, and Assessments and by Marine Corps Lieutenant General Charles C. Krulak, who commands the Marine Corps Combat Development Command. The Committee welcomes you all, and your prepared statement and biographies will be made part of the record.

Dr. Whitman, please briefly summarize your statement for us now.

SUMMARY STATEMENT OF DR. WHITMAN

Dr. WHITMAN. Thank you. I appreciate the opportunity to be here today to talk to you about our Navy research and development program. I understand that we will be with you again tomorrow to discuss procurement programs.

As you have noted, I have Vice Admiral Bill Owens, the Deputy Chief of Naval Operations for Resources, Warfare Requirements and Assessments; and Lieutenant General Chuck Krulak, Commanding General of the Marine Corps Combat Development Command.

I am currently serving as the Senior Navy Acquisition Official. I brought Admiral Owens to answer questions you may have that address Navy requirements, and General Krulak will be happy to contribute to answers that concern programs affecting the Marine Corps. The three of us will be back for tomorrow's procurement hearing.

I have a detailed written statement that I request be entered in the record. I also have a few brief opening remarks.

The Navy's research and development program is in the midst of a significant sea change. Our response to the challenge of shifting our focus to the needs of regional and littoral warfare while simultaneously downsizing both the force and its supporting infrastructure is framed by a small number of guiding principles.

First, we will continue to support a vigorous science and technology effort which particularly emphasizes future opportunities for greater combat effectiveness tailored to the support of joint regional and littoral warfare.

Secondly, we will seek, wherever possible, to field newly required capabilities by modifying existing platforms. Our major theme is the systematic evolution of enhanced littoral warfare capabilities for our current ships and aircraft through phased improvements and measured upgrades to sensors, weapons and systems.

Lastly, we intend to further strengthen our partnership with industry by emphasizing the use of commercial and industrial standards wherever it makes sense, by shouldering a fair share of development risk in our more traditional acquisition programs, and by respecting the need for maintaining a strong industrial base in areas of vital interest.

We deeply appreciate the central role of the Congress in supporting the past RDT&E efforts which created both today's naval forces and a solid foundation for building toward the uncertainty of the future. We have not always agreed about the details—there has been debate and compromise—but the need for maintaining the technical edge described at the outset has been universally shared among us.

The Department of the Navy looks forward to your continuing support and a fruitful collaboration in this important effort.

One final note: I would like to recognize the excellent working relationship that we have been able to establish with the committee's staff, their dedication and professionalism are noteworthy. This concludes my opening remarks.

[The biographical sketches and joint statement of Dr. Whitman, Admiral Owens, and General Krulak follow:]

Dr. Edward C. Whitman
Senior Civilian Official
Office of the Assistant Secretary of the Navy
(Research, Development, & Acquisition)

Dr. Edward Whitman was designated by the former Secretary of the Navy to perform the duties of the Assistant Secretary of the Navy (Research, Development and Acquisition) (ASN(RDA)) during the present transitional period and is serving in this capacity as the Department of the Navy's senior procurement and RDT&E official. Since June 1990, he has filled the position of Deputy Assistant Secretary for C^4I, Electronic Warfare, and Space, advising the Assistant Secretary within that purview, and assisting him in the oversight of both Navy acquisition programs and the Department's Information Resource Management activities.

Born in Newark, New Jersey, Dr. Whitman attended the Massachusetts Institute of Technology and participated as an undergraduate in the cooperative program in electrical engineering at the Naval Surface Weapons Center, White Oak, Maryland. He received the bachelor's and master's degrees in electrical engineering from MIT in January 1963 and then the degree of Electrical Engineer (E.E.) in June 1964. At that time, he returned to White Oak as an electrical engineer and worked on a variety of underwater weapons, including mines, torpedoes, and sonobuoys. He received a Ph.D. in electrical engineering from the University of Maryland in June 1970. In June 1975, he was promoted to Chief of the Sensors Division, where he was engaged primarily in line management of the Navy's in-house effort on sensors for undersea mines and development of a corresponding technology base.

In August 1979, Dr. Whitman was appointed Science Advisor to the Commander, U.S. Sixth Fleet, under the auspices of the Navy Science Assistance Program (NSAP), and served in the Mediterranean area in that role for two years. Upon his return to the United States in June 1981, he became Director of the Naval Warfare Division at the Defense Advanced Research Projects Agency (DARPA), where for three years he directed DARPA's program for the application of new technology to naval warfare problems.

Following his tour at DARPA, Dr. Whitman spent three years in the Space, Command and Control Directorate of the Chief of Naval Operations (OP-094), first as Deputy Director of the Planning and Programming Division and then as Chief Scientist. In OP-094, he was responsible for technical monitoring and assessment of various Navy C^3 programs, technology base liaison, and planning and programming for the Navy Command and Control System. He was then named Technical Director of the Anti-Submarine Warfare (ASW) Program Directorate in the Space and Naval Warfare Systems Command, with particular responsibility for the Navy's ASW system architecture. Just prior to his assignment in ASN(RDA), he served as Senior Technical Advisor in the Defense Mobilization Systems Planning Activity.

BIOGRAPHY OF
VICE ADMIRAL WILLIAM A. OWENS, USN
DEPUTY CHIEF OF NAVAL OPERATIONS
RESOURCES, WARFARE REQUIREMENTS AND ASSESSMENTS (N-8)

Vice Admiral William Arthur Owens entered the nuclear submarine program in 1962. He has served in four strategic nuclear powered submarines and three nuclear attack submarines, including tours as Commanding Officer, USS SAM HOUSTON (SSBN 609) and USS CITY OF CORPUS CHRISTI (SSN 705). He has also commanded Submarine Squadron FOUR and Submarine Group SIX. He has served as a member of the U.S. Navy's first Strategic Studies Group, as Executive Assistant to the Vice Chief of Naval Operations, and as Director Office of Program Appraisal in the Office of the Secretary of the Navy. In 1987, he became the first director of the U.S. Navy's Strategic Think Tank (now Strategic Planning and Analysis Group). Vice Admiral Owens served as the Senior Military Assistant to the Secretary of Defense from July 1988 to August 1990. He was confirmed by the U.S. Senate as a Vice Admiral on August 4, 1990. He commanded the U.S. Sixth Fleet and NATO's Naval Striking and Support Forces Southern Europe from November 2, 1990 to July 9, 1992. In July 1992, he became the Deputy Chief of Naval Operations for Resources, Warfare Requirements and Assessments (N-8).

Vice Admiral Owens was born in Bismarck, North Dakota on May 8, 1940. He is a 1962 graduate of the U.S. Naval Academy. He holds B.A. and M.A. degrees in Politics, Philosophy and Economics from Oxford University, Oxford, England and a Masters Degree in Management from The George Washington University, Washington, D.C.

Vice Admiral Owens and his wife, Monika, have one son, Todd, a Midshipman at the U.S. Naval Academy.

UNITED STATES MARINE CORPS

HEADQUARTERS MARINE CORPS, DIVISION OF PUBLIC AFFAIRS
WASHINGTON, D.C. 20380, (703) 614-4309

LIEUTENANT GENERAL CHARLES C. KRULAK, USMC

Lieutenant General Charles C. Krulak is currently serving as the Commanding General, Marine Corps Combat Development Command, Quantico, Virginia.

General Krulak was born on March 4, 1942 in Quantico, Virginia. He graduated from the U.S. Naval Academy in 1964 with a B.S. degree in Engineering and also holds an M.S. degree in Labor Relations from George Washington University (1973). He is a graduate of the Amphibious Warfare School (1968); the Army Command and General Staff College (1976); and the National War College (1982).

Since his commissioning and graduation from The Basic School at Quantico, General Krulak has held a variety of command and staff positions. He commanded a platoon and two rifle companies during his two tours of duty in Vietnam; Commanding Officer, Special Training Branch, and Recruit Series, MCRD, San Diego, Calif. (1966-1968); Commanding Officer, Counter-Guerilla Warfare School, NTA, Okinawa (1970); Company Officer, U.S. Naval Academy (1970-1973); Commanding Officer, Marine Barracks, Naval Air Station, North Island, Calif. (1973-1976); and Commanding Officer, 3d Battalion, 3d Marines (1983-1985).

General Krulak's staff assignments include: S-3 of the 2d Battalion, 9th Marines (1977-1978); Chief of the Combat Arms Monitor Section, Headquarters Marine Corps, Washington, D.C. (1978-1979); Executive Assistant to the Director of Personnel Management, Headquarters Marine Corps (1979-1981); Plans Officer at FMF Pacific (1982-1983); Executive Officer, 3d Marines, 1st MEB; Assistant Chief of Staff for Maritime Pre-positioning Ships, 1st MEB; Assistant Chief of Staff, G-3, 1st MEB; and the Military Assistant to the Assistant Secretary of Defense for Command, Control, Communications and Intelligence, Office of the Secretary of Defense.

He was assigned duty as the Deputy Director, the White House Military Office in September 1987. While serving in this capacity, he was selected for promotion to brigadier general in November 1988. He was advanced to that grade on June 5, 1989, and assigned duties as the Commanding General, 10th Marine Expeditionary Brigade/Assistant Division Commander, 2d Marine Division, FMF, Atlantic, Camp Lejeune, N.C., on July 10, 1989. On June 1, 1990 he assumed duties as the Commanding General, 2d Force Service Support Group/Commanding General, 6th Marine Expeditionary Brigade, FMF, Atlantic, Camp Lejeune, N.C. He served in this capacity until July 12, 1991, and was assigned duty as Assistant Deputy Chief of Staff for Manpower and Reserve Affairs (Personnel Management/Personnel Procurement), Headquarters Marine Corps on Aug. 5, 1991. He was advanced to major general on March 20, 1992. General Krulak assumed his current assignment on Aug. 24, 1992, and was promoted to his present grade on Sept. 1, 1992.

His decorations and medals include: the Defense Distinguished Service Medal; Distinguished Service Medal; Silver Star Medal; Bronze Star Medal with Combat "V" and two gold stars; Purple Heart with gold star; Meritorious Service Medal; Navy Commendation Medal; Combat Action Ribbon; Presidential Unit Citation with bronze star; National Defense Service Medal with one bronze star; Vietnam Service Medal with silver star and two bronze stars; Southwest Asia Service Medal with two bronze stars; Sea Service Deployment Ribbon; Republic of Vietnam Cross of Gallantry; Republic of Vietnam Meritorious Unit Citation (Gallantry Cross Color); Republic of Vietnam Meritorious Unit Citation (Civil Actions Color, 1st Class); the Republic of Vietnam Campaign Medal; and the Kuwait Liberation Medal.

Lieutenant General Krulak is married to the former Zandra Meyers of Annapolis, Maryland. They have two sons, David and Todd.

(Revised Oct. 2, 1992 HQMC)

NOT FOR PUBLICATION UNTIL
RELEASED BY THE
HOUSE APPROPRIATION COMMITTEE
DEFENSE SUBCOMMITTEE

STATEMENT OF

DR. EDWARD C. WHITMAN
SENIOR CIVILIAN OFFICIAL
OFFICE OF THE ASSISTANT SECRETARY OF THE NAVY
(RESEARCH, DEVELOPMENT AND ACQUISITION)

AND

VICE ADMIRAL WILLIAM A. OWENS, USN
DEPUTY CHIEF OF NAVAL OPERATIONS
RESOURCES, WARFARE REQUIREMENTS AND ASSESSMENTS

AND

LIEUTENANT GENERAL CHARLES C. KRULAK, USMC
COMMANDING GENERAL
MARINE CORPS COMBAT DEVELOPMENT COMMAND

BEFORE THE

SUBCOMMITTEE ON DEFENSE

OF THE

HOUSE APPROPRIATIONS COMMITTEE

ON THE FY 1994

NAVY RESEARCH AND DEVELOPMENT PROGRAM

APRIL 21, 1993

NOT FOR PUBLICATION UNTIL
RELEASED BY THE
HOUSE APPROPRIATIONS COMMITTEE
DEFENSE SUBCOMMITTEE

Mr. Chairman, distinguished members of the Defense Sub-Committee, I appreciate this opportunity to discuss the Navy's Research, Development, Test and Evaluation program.

Since the days of the U.S.S. CONSTITUTION, the United States Navy has invested in technologically superior ships, aircraft and weapon systems to provide our Sailors and Marines a warfighting edge over all potential adversaries. The technology investments made over the last few decades were key to ending the Cold War and have provided our nation with maritime forces second to none. This was particularly well demonstrated during Operation DESERT STORM. Now however, with sophisticated weapon systems readily and widely available on the world market and with rising unrest in numerous areas of the world fueling the potential for regional conflict, it is imperative that we continue to invest in RDT&E to ensure that we do not give up that warfighting edge.

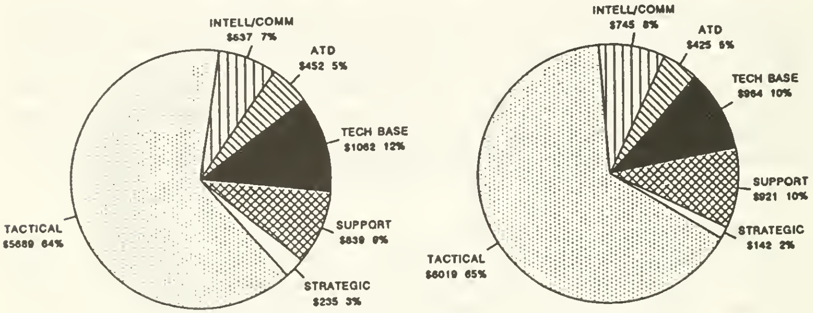
Responding to the new realities of the post Cold War world, the Navy has refocused its research and development investment strategy to highlight areas vital to joint littoral warfare. Programs that were conceived during the Cold War Era but which no longer substantially support the regional strategy are being refocused or terminated. This process is expected to be continued through the Secretary of Defense's "Bottom-Up Review" which is currently underway. In addition, the compelling urgency to develop and field new weapon systems quickly to combat a monolithic global threat has vanished. Instead, our emphasis has shifted to research and development for comprehensive risk reduction prior to entering into series production.

Extensive changes in the Navy's investment priorities have already occurred as a result of the "...From the Sea" white paper. Priorities have shifted to areas that enhance joint and combined operations and emphasize activities such as surf-zone mine countermeasures and shallow-water mine detection; shallow water ASW to combat the quiet diesel submarine threat; precision strike and standoff weapons; Naval Surface Fire Support; theater surveillance to localize and target both enemy positions and infrastructure; integrated and joint command and control capabilities; Theater Ballistic Missile Defense; space and electronic warfare; and both AAW and ASW individual unit self defense.

Our RDT&E budget request for FY 1994 (Figure 1) reflects an increase of $282M over FY 1993 funding. The increase occurs mainly in Tactical Programs. In this area for example, Ship Self Defense funding has been increased to emphasize our need to ensure adequate defense for our existing fleet. Funding for the New Attack Submarine supports increased emphasis on a lower cost attack submarine. The F/A-18 E/F E&MD contracts have been definitized and the program is fully funded. The A/FX development effort is on track and includes competitive prototyping of the airframe. The budget request for

RDT&E,N BY BUDGET ACTIVITY

(FYDP $ IN MILLIONS)



FY 1993
$8,934

FIGURE (1)

FY 1994
$9,216

Strategic Programs reflects significant decreases in strategic weapons programs based on a reduction in the potential threat. In response to Congressional direction, we have restructured our RDT&E program using a philosophy that focused on: consolidation of related programs; realignment of program elements into appropriate RDT&E categories; and retitling program elements to reflect consolidation while maintaining project visibility. Our FY 1994 budget submission displays the effect of this restructuring by reducing the number of program elements from 223 in FY 1993 to 171 in FY 1994. Details regarding our RDT&E programs are contained in the budget justification material.

ORGANIZATIONAL CHANGES

In our current fiscal climate it is essential that every dollar invested in research and development be spent in accordance with a coordinated plan. To administer R&D efforts more effectively, we have streamlined our top level program management structure by realigning the areas of responsibility of our Program Executive Offices so that similar development programs now fall under consolidated offices. This promotes common solutions for common problems, avoids duplication of effort between programs, and realigns program priorities to conform with current threats.

For example, robust ship AAW defense capability is a priority requirement for naval forces to conduct joint missions in the littoral environment. To achieve this goal in a systematic fashion, the Navy has reorganized its management, restructured its system engineering and analysis process and coordinated its acquisition program for Ship Self Defense. All pertinent AAW Ship Self Defense elements have been centralized under a single Program Executive Officer (PEO). This has consolidated funding lines, created an analysis-based investment strategy to support tradeoffs of candidate Ship Self Defense upgrades, established a land and ship-based engineering, integration and testing process, implemented ship class combat system planning, created a mechanism for technology infusion and brought the entire Ship Self Defense effort under the acquisition procedures of Department of Defense Instruction 5000.2 as a coordinated program. The Navy program is now structured to develop, engineer, integrate, produce and introduce to the fleet total ship AAW defense systems capable of meeting the evolving challenge. We have similarly consolidated numerous mine warfare programs under a single PEO to more effectively focus efforts in this vital littoral warfare capability.

SCIENCE AND TECHNOLOGY

Last year the Navy took the initiative to completely restructure its Science and Technology headquarters in response to the increasing demands of a changing world and evolving defense requirements. While capitalizing on the strengths and historic accomplishments of the Congressionally created Office of Naval Research, we consolidated the entirety of our science and technology infrastructure, from basic research to manufacturing process technology, under a single headquarters organization--the new Office of Naval Research. In the process, we disestablished the previous Office of Naval Technology as well as the Office of Advanced Technology. We expect to gain better integration of all our science and technology investments and accelerate the transition of the fruits of our research investments, principally conducted in the nation's universities, into technology development and manufacturing processes on U.S. production lines. These initiatives were recently enhanced by the conclusion of a Memorandum of Understanding between the new Office of Naval Research and the National Science Foundation, formally linking their investments and educational support programs for the betterment of both organizations and the nation. Success of this endeavor will not be measured in terms of peer-reviewed journals on a library shelf, but in terms of new technology products available from U.S. production lines at a cost their customers can afford.

Department of the Navy Science and Technology (S&T) programs support future maritime operations in the complex environment of the littoral. They remain closely aligned with the Department of Defense strategy embodying seven principal "thrusts" -- global surveillance and communications, precision strike, air superiority and air defense; sea control and undersea superiority; advanced land combat; synthetic environments; and technology for affordability. Our S&T programs support these thrusts by progressively focusing on applications at the component, subsystem, system and platform level. These programs are well coordinated with those of the Army and Air Force through the Tri-Service Reliance initiative to avoid duplication and overlap among the Services. The Navy balances its S&T investment and research efforts among colleges, universities, industry, the four Naval warfare centers and our corporate laboratory, the Naval Research Laboratory.

Key to the Department of the Navy S&T strategy is to work closely with industry and guide technology toward specific capabilities that can be proven through Advanced Technology Demonstrations (ATDs). The most promising technological opportunities will be considered for transfer toward further development. ATDs provide the opportunity to mitigate technical and production risk and to provide proof of new concepts prior to commitment to full scale development or incorporation as a technology upgrade to an existing system. This produces both cost efficiency and greater assurance of successful subsystem and system development.

The Navy is making dedicated R&D efforts to protect our environment. Critical programs are developing alternatives to the use of ozone depleting substances in fire fighting, air conditioning and refrigeration, and cleaning applications. Other programs are ensuring that Navy ships are environmentally sound by developing shipboard systems to manage oily, solid and plastics waste, non-oily wastewater and hazardous waste.

EXPLOITATION OF COMMERCIAL PRODUCTS AND DUAL USE TECHNOLOGIES

An area that has gained increased importance as budgets decrease and commercial technology continues to outpace military developments in areas critical to defense, is the increased direct use of commercial products, frequently described as Commercial-Off-The-Shelf (COTS) and Non-Developmental Items (NDI). These strategies capitalize on technological successes of the commercial sector and allow rapid and cost effective insertion of state-of-the-art technology into our combat and support systems. Military-specific development of new capabilities can be costly and time consuming, as well as expensive to support over the life cycle of a system. Substituting a commercial or industrial equivalent can save much of that investment.

Use of COTS and NDI has already proven highly successful in high technology fields such as computers and communications. In support of this success, Department policy has changed fromrequiring the use of unique Navy-developed computer resources in mission critical systems to one that stresses the use of COTS and NDI computer resources which conform to open systems interface standards. For example, our Tactical Advanced Computer (TAC-3) is a competitively acquired commercial processor which satisfies the functional requirements of a wide range of command/control and sensor systems. The successor, TAC-4, will likewise be based on commercial products which conform to open system standards. We will be receiving proposals this summer and anticipate a total buy exceeding $1 billion for both Defense and non-Defense agencies. The new computers will be used for both tactical and administrative applications aboard ship, simplifying logistics support, training and backup requirements.

The Naval Tactical Command System Afloat (NTCS-A) is an example of the Navy's desire to move to an open architecture, evolutionary acquisition strategy for C3I systems. Through extensive use of COTS and NDI - in fact, the TAC-3 and TAC-4 computers - the Navy has been able to field a range of modular decision support capabilities to the fleet as software applications built on a common core. NTCS-A has accrued substantial monetary savings, allowing the fielding of appropriately scaled systems, with greater capability, to more classes of ships, within a constrained budget, than would be possible under our former "gray box" paradigm. This is one of the most successful C3I systems we have ever fielded and is being used as the basis for its ashore counterpart - the Operations Support System.

Similarly, the Navy is exploiting commercial product development extensively in the strategic sealift program. Shipbuilders and vendors are involved in all aspects of design and production to ensure maximum use of commercial industry design and construction expertise for both conversion and construction of sealift ships. In addition, the program will use proven non-developmental commercial equipment for class standard equipment, such as ramps and cranes.

Throughout the entire R&D process, a principal Department goal is to transfer scientific knowledge and technology, developed as a result of the Department's investment, to industry. This technology transfer can provide dual use benefits which apply to both military requirements and civilian applications. Currently, the Navy has established more than 90 technology transfer partnerships with industry to exploit technologies developed with federal funds for commercial or dual-use purposes. For example, a portable sensor system was developed for use to detect possible biological warfare agents during DESERT STORM. The sensor uses foreign agent antibodies or DNA coated fiber optic probes to quantitatively determine existence of even very small amounts of a foreign agent. It was recognized that this technology could be used to test for drugs of abuse, steroids, lead, etc. in civil applications, and a patent has been licensed to exploit this technology with a private drug test company. Another example is Navy's work in advanced materials for use in integrated circuits. A team of Navy scientists created new techniques for producing ultra-fine resolution patterns for integrated circuits and to metalize plastics and achieve high adhesive strengths. These material developments also provided the means to give U.S. industry a competitive edge in integrated circuits through transfer of this technology under a licensing agreement with a U.S. firm.

Additionally, advances in areas such as advanced material science, polymers and virtual reality all contribute to the leverage afforded our industry through Navy R&D efforts. Other areas that are currently providing dual use benefits include ongoing work in high performance turbine engines, medical technology such as ONR's synthetic blood effort, manufacturing processes and environmental support. Still another example of increasing public access to Navy technology is the recent use of SOSUS (Sound Surveillance System), which was built to track Soviet submarines at long range, to track marine mammals, detect seismic disturbances, and assist in fisheries protection and drug enforcement activities. Finally, programs such as the V-22 tiltrotor effort have obvious and direct commercial applications.

NAVAL AVIATION

Robust RDT&E efforts in Naval aviation provide insurance for our national security and supports both a strong economy and the evolving aerospace technology base. Sustaining a strong technical base and internationally competitive aeronautical industries is vital to the Nation's ability to acquire and maintain a strong Naval aviation component.

Several key strategic drivers are guiding our research, development and acquisition efforts in Naval aviation. First, the Navy seeks to foster joint efforts that reduce costs, capitalize on broader expertise and allow us to field common weapons and platforms with our sister services. These efforts also avoid unnecessary duplication of effort. The A/FX aircraft, Joint Standoff Weapon (JSOW)/Joint Direct Attack Munitions (JDAM), Advanced Medium Range Air-to-Air Missile (AMRAAM), and AIM-9X weapon systems are major joint defense acquisitions involving significant R&D activity and technology development. The second strategic driver is a growing imperative for mission flexibility and multi-mission capability. With anticipated force structure and procurement reductions, it is essential that the key investments we do make represent the most efficient and versatile use of our scarce resources. This approach facilitates our third driver: to "neck down" to fewer platforms and weapon systems in order to reduce operating and support costs.

While our long-term R&D and acquisition strategy is being built on these basic principles, the following components serve as additional guideposts as we transition to a smaller aviation force structure:

- Sequencing major programs for affordability; phasing R&D and initial procurement to minimize program overlap.
- Greater emphasis on commonality and multilateral use of proven components.
- Selective modernization of existing aircraft and weapons where cost effective.
- Improved monitoring and fatigue life extension for some Type/Model/Series aircraft, such as the F-14, F/A-18, E-2 and P-3C.
- Emphasizing improvements to current systems.

Our plan to modernize and "neck down" our tactical aircraft is founded on a sequential acquisition strategy with two principal components, the F/A-18 E/F, and the A/FX. The F/A-18 E/F is our near term priority. The A/FX is the essential pillar for carrier airwings in the decades to follow.

The F/A-18 E/F will provide enhanced survivability, increased range, longer endurance, greater payload, and improved carrier suitability over the combat-proven C/D version which it will eventually replace. On track and on budget, the E/F variant of the Hornet will greatly enhance our aircraft carriers' strike and battlespace dominance capability. Both McDonnell Aircraft Corporation and General Electric Aircraft Engines have made significant progress since the E/F development program began in July 1992. The airframe has gone through a successful Initial Design Review with Preliminary Design Review (PDR) on track for June. The engine development has progressed equally as well through its PDR toward a significant event, First Engine To Test, in May. We expect delivery of the first production E/F aircraft before the end of the decade.

A/FX will serve as the centerpiece of carrier aviation well into the twenty-first century. Intended as a key national capability, A/FX's joint development and acquisition will permit the direct replacement of five Type/Model/Series aircraft in the Navy and Air Force inventories. The A/FX will embody multi-mission, stealth and survivability, range, payload and weapons capability of unparalleled dimension in a single airframe. The A/FX will support the Navy's joint warfare mission by providing the capability of striking over long distances, day or night, to destroy a broad range of fixed or mobile land targets and to engage enemy surface units at sea. In addition, the A/FX will have an effective and flexible anti-air warfare capability for offensive (strike escort and self protection) and defensive operations.

In compliance with Congressional direction, of four teams currently participating in Concept Exploration and Definition studies, two will be competitively selected for Cost Plus Incentive Fee contracts for the Demonstration and Validation phase in about a year. The program is structured for subsequent downselection to a single contractor team for a cost type contract to proceed into the Engineering and Manufacturing Development phase. The Navy and Air Force have signed a Joint Operational Requirements Document and together are poised to execute this vital program.

In accordance with the compromise proposed by the Secretary of Defense in July 1992, the Department of the Navy is pursuing a dual path to fulfill the Marine Corps' medium lift requirement. This involves consideration of both the V-22 and helicopter alternative studies. The helicopter alternative studies, expected to complete in late April, will provide performance and cost information on possible new helicopter designs as well as viable modifications to existing helicopters. Information from these studies along with similar data on the V-22 will be used in a Cost and Operational Effectiveness Analysis.

Meanwhile, development of the V-22 is continuing. On October 22, 1992, a letter contract was awarded to the contractor team of Bell-Boeing. Under this Engineering and Manufacturing Development contract, the contractors will modify two existing development aircraft and manufacture four new aircraft. The focus of this phase will be on weight reduction and controlling production cost of the aircraft while still meeting the Marine Corps' requirements. During the course of this new contract, the aircraft will be fully qualified and carried through operational test and evaluation. In addition, we are pursuing cost effective upgrades to our UH-1N and AH-1W helicopters in order to maintain their viability for years to come.

Our efforts to improve the effectiveness of ASW aircraft in littoral environments include the Advanced Low Frequency Sonar (ALFS) program which is currently in the Engineering and Manufacturing Development phase. This new dipping sonar provides for a significant improvement in search capability over the current system, and could possibly be integrated into a common aircraft and core architecture by combining SH-60B Block II and ALFS development. A move to a common airframe for both the SH-60F CV Helo and SH-60B LAMPS MK III mission would allow for a single integration of ALFS, reduced life cycle costs and better employment flexibility. In addition, the Airborne Deployable Active Receiver (ADAR) sonobuoy, in conjunction with the Airborne Active Adjunct (AAA) sonobuoy, will provide the P-3C and S-3B aircraft with significant active search capability against quiet diesel submarines in shallow water.

SHIP AND SUBMARINE PROGRAMS

SUBMARINES

With the termination of the SEAWOLF program last year, a significant gap is anticipated in submarine production. Studies of the industrial base have been conducted over the last year, and several high level reviews are underway now to combine the results of these studies, insights from shipyard and plant visits and other available data in a coherent picture. These reviews will influence decisions made this summer on the FY 1995 through FY 1999 budgets and in the "Bottom-Up Review".

Although the SEAWOLF program was formally terminated, research and development in support of both the SEAWOLF and New Attack Submarine programs is continuing. SEAWOLF work includes continued component shock testing, completion of prototype propulsor fabrication, completion of Large Scale Vehicle tests, and at-sea tests of the Advanced Special Hull Treatment (ASHT). New Attack Submarine work will support achieving Milestone I, development of preliminary designs, design of HM&E and combat systems and hardware development of long lead material. These efforts are essential to retaining the highly skilled personnel in government and industry who represent the cutting edge of our submarine design and production technology.

AMPHIBIOUS FORCES

In recognition of the key contribution that expeditionary forces will make in regional and littoral conflict, we have entered into preliminary design of our next amphibious ship, the LX. The LX design will retain key capabilities of four aging ship classes that are currently in service and subsume them in a multi-capable platform. This class will replace the 45 amphibious ships scheduled to retire between now and 2007 and must support the fiscally constrained lift goal of 2.5 Marine Expeditionary Brigades (MEBs) and provide the flexibility to construct a variety of Amphibious Ready Groups (ARGs) for forward deployments. The Navy has conducted a Cost and Operational Effectiveness Analysis (COEA) which reviewed a wide range of options for the LX. These options (a total of 16) included existing ship programs (LSD and LHD), modifications of those existing ship programs, a wide range of new ship designs and Service Life Extension Programs (SLEPs) of existing ships. The COEA showed that the Navy should not replace its retiring ships one-for-one but rather procure a class of medium sized (23,000 ton) multi-dimensional ships with full-service aviation capability and over-the-horizon (OTH) assault capability similar to the current LPDs. Thus, the LX is configured to be the final element of a flexible three ship ARG when combined with the recently acquired LHA/LHD and LSD classes. The Defense Acquisition Board (DAB) approved the Navy's decision in January, 1993 and the program has entered Phase I Demonstration and Validation Design development with lead ship award anticipated in FY 1996.

A further necessity for enabling our forces to pursue littoral and region conflicts is modernizing our over-the-beach amphibious assault capability. The tactics of the foreseeable future will place our naval forces sufficiently off shore to both provide adequate warning and protection from counterattack and to provide the tactical flexibility and surprise of maneuver from the sea to a wide range of landfalls. To accomplish that, however, we must compliment our aerial assault and LCAC forces with armored assault vehicles capable of armed insertion even over hostile beaches. Launching such attacks from over-the-horizon ranges means greatly increasing water transit speed must be a major goal in replacing our aged assault vehicle fleet. Under our Advanced Amphibious Assault (AAA) Program, a concerted effort has been underway during an extended Concept Development Phase to reduce the technical risk in developing such vehicles with the demonstration of over 30 knot speed with nearly full scale test vehicles. These and other efforts on composite armor, retractable suspensions, improved propulsion, etc. are leading to a Milestone I DAB to initiate AAA Demonstration and Validation efforts early in the second quarter of FY 1994.

SURFACE COMBATANTS

Although the centerpiece of our surface combatant program for the next decade is the DDG-51 Class AEGIS destroyer, a second major theme is the systematic evolution of enhanced littoral warfare capabilities for that class and its remaining predecessors through phased improvements in platform subsystems and weapons.

In some areas, low levels of R&D funding in mature programs are being applied to reduce costs, improve efficiency of design or more effectively meet the new threat. For example, the DDG 51 Flight IIA design specifically tailors DDG 51 Class ships to changing world threats with dual emphasis on open-ocean and littoral operations. The Flight IIA design is the result of a CNO-directed study to define an affordable DDG 51 variant which meets the minimum peacetime forward presence and war fighting requirements of the 21st Century. Flight IIA ships will be equipped with a Baseline 6 AEGIS Combat System and incorporate a dual helicopter hangar capable of supporting LAMPS MK III or other helicopters configured for multiple missions including anti-surface, anti-submarine, mine warfare and naval surface fire support in regional and blue-water scenarios. The configuration will also include a mine detection capability and, when available, Evolved Sea Sparrow Missiles for short range ship self defense. DDG Flight IIAs are intended to replace retiring helicopter-capable battle force combatants and will include a variety of cost reduction efforts that will save both procurement and life cycle costs.

The AEGIS EDM-4B program will be an effective radar in the littoral region of the world as well as in open ocean application due to the new signal processor that will be capable of identifying threats in sea clutter and land background. The Navy is continuing this program as structured several years ago.

R&D funding for the Phalanx Close-In Weapon System (CIWS) is being used to develop radar processing improvements and incorporate advanced electro-optic capabilities to better counter low elevation, low RCS targets and improve capability in an ECM environment. In addition, it is our proposal that a surface mode be incorporated into the CIWS to fulfill the requirements of the Advanced Minor Caliber Gun System (AMCGS) program for defending against the high-speed maneuvering surface threat and low, slow air threat which would be expected in a littoral warfare scenario. Adding this feature to the CIWS instead of acquiring a new system is expected to result in avoidance of up to one billion dollars in life cycle costs, while providing 33% to 400% more capability than other gun alternatives. In other AAW developments, the United States is participating in the cooperative development of a kinematically improved Evolved Sea Sparrow Missile (ESSM). The Rolling Airframe Missile (RAM) Weapon System is a cooperative production program with Germany. Development of an Infrared Mode Upgrade (IRMU) and low altitude fuse are being pursued as an upgrade to RAM.

Recent studies have concluded that the theater ballistic missile (TBM) threat is present and growing, particularly in the context of regional conflict. Sea-based assets can provide a significant contribution to the national theater ballistic missile defense objectives. Modification to the current AEGIS anti-air warfare capabilities for TBM application is promising and feasible. Control software that permits the AEGIS radar to detect above the current controlled horizon will permit volume search for TBM. A new ordnance and multi-mode guidance section for SM-2/BLK IV will provide a more capable TBM interceptor. The Navy has established an ATBM Program Manager within the Strategic Systems Program Office to manage this effort. The basic approach is to address a sea-based system for exo and endo atmospheric application including modification to the basic AEGIS and STANDARD Missile systems, other off board sensors, and the Army's Theater High Altitude Area Defense. The Navy is conducting the necessary experiments and studies on how best to implement this effort. The Navy's entire TBM effort is SDIO funded. No Navy funds are involved.

The most significant R&D effort being undertaken for the surface Navy is Ship Defense including both Cooperative Engagement Capability (CEC) and Ship Self Defense (SSD). Significant Navy achievements in ship defense have been detailed in the Secretary of the Navy's March 1, 1993 report to Congressional Defense Committees. The intent of CEC is to provide real time shipboard sensor information data transfer to allow surface ships to utilize off-board sensors and collaborate in prosecuting AAW engagements against multiple targets. The Ship Self Defense effort will result in the time-phased implementation in multiple ship classes of integrated anti-air warfare systems.

In longer term technology effort, aimed at future DDG-51 flights as well as new ship class for the 21st Century, the Advanced Ship Machinery Program is developing a series of advanced propulsion, power and auxiliary subsystems that offer significant potential to reduce costs, standardize components, improve producibility and prepare for the transition to a unified HM&E approach for the future. The most significant of these, the Intercooled Recuperative Gas Turbine is targeted for a FY 1999 DDG-51 and is expected to yield fuel savings of 30%. The Zonal Electrical Distribution and Standard Monitoring and Control Systems will see even earlier applications in FY 1994 and FY 1996 hulls respectively.

CONCLUSION

As a reflection of the on-going reorientation of our entire defense establishment, the Navy's RDT&E program is in the midst of a significant sea change which, I believe, has been outlined in the preceding sections. Our response to the challenge of shifting our focus to the needs of regional and littoral warfare while simultaneously downsizing both the force and its supporting infrastructure is framed by a small number of guiding principles. First, we will continue to support a vigorous science and technology effort which particularly emphasizes future opportunities for force multiplication in regional conflict. Secondly, we will seek, wherever possible, to field newly required capabilities by modifying existing platforms, weapons and systems through measured upgrades and conservative improvement programs. Lastly, we intend to further strengthen our partnership with industry by emphasizing the use of commercial and industrial equipment wherever it makes sense, by shouldering a fair share of development risk in our more traditional acquisition programs, and by respecting the need for maintaining a strong industrial base in areas of vital interest.

We have deeply appreciated the central role of the Congress in supporting the past RDT&E efforts which created both today's naval forces and a solid foundation for building toward the uncertainty of the future. We have not always agreed about the details - there has been debate and compromise - but the need for maintaining the technical edge described at the outset has been universally shared among us. The Department of the Navy looks forward to your continuing support and a fruitful collaboration in this important effort.

Mr. WILSON. We will proceed with questions then. Admiral Owens, do you have an opening statement?

Admiral OWENS. I do not.

Mr. WILSON. General Krulak?

General KRULAK. I do not, sir.

STRATEGY FOR BUDGET

Mr. WILSON. Admiral, please describe for us your strategy in establishing the essential requirements for the R&D budget for the Navy?

Admiral OWENS. We have been through a revolutionary change in the Navy and the Marine Corps and we are excited and optimistic about what it means. There have been three major things that have happened in the Navy/Marine Corps team. First is the ". . . From the Sea" document that I am sure you are familiar with.

Second is a dramatic reorganization of the Navy staff that has been a hallmark in the way we have done business this last year.

We have subordinated the three warfare "barons," the air, surface and submarine "barons," into my office. We have added a two-star Marine Corps general responsible for Expeditionary Warfare. He is responsible for amphibious shipping, mine warfare and naval special operations forces.

Thirdly, we have an admiral on our staff now with the responsibility for interfacing with our fleet commanders for requirements from the fleet, the three Navy four-star commanders.

The organization is the second major item, and third is a whole new process through which we look at the Navy and its requirements from the standpoint of what we think are the national requirements for naval forces. There are six major assessment areas—joint strike, joint littoral warfare, joint surveillance, joint space and electronic warfare/intelligence, strategic deterrence and strategic sealift/protection.

I didn't mention ASW, a traditional Navy mission area, because we think that it is only a means to these national ends. We have spent hundreds of hours together in this last six months trying to come to grips with what we should best do with our naval forces to meet these important national goals—playing war games, having concerns, et cetera.

Three major changes have taken place to allow us to better serve your needs and our own needs for what the Navy and Marine Corps can provide to our country.

Our strategy has been one of looking at regional warfare, littoral requirements, looking at joint operations, and tailoring forces from the sea for this sort of expeditionary environment.

Our strategy has been put into budget documents in the form of our FY 1994 budget, which is very different, we think, from any Navy budget before, and we are satisfied that we have a plan that is affordable from FY 1994 through the end of the century to be able to fit inside the constraints of a budget, but at the same time be oriented to strategies and mission areas that count for our country.

That is an overview of where we have been. I will be glad to go into more detail if you would like me to.

TACTICAL AIRCRAFT

Mr. Wilson. Why don't you tell me what we are doing with airplanes?

Admiral Owens. Airplanes in general, Mr. Congressman? Why am I not surprised by this question?

Of course the TACAIR issue, I will talk about TACAIR first and if you would like, we can get into the support aircraft areas.

Mr. Wilson. No.

Admiral Owens. TACAIR has been the principal concern to us in our reorganization, both in our strategy and in our process, so we have spent hundreds of hours thinking about this. The critical thing for us as we look to the future is the procurement and the supporting R&D for the F/A-18E and F. We think it is a critical airplane for the future. The F/A-18E and F is affordable, brings significant additional capabilities that I would be glad to go into more detail on if you wish.

It is an airplane that we can procure with little technical risk and we believe that it is an airplane that we must have for the Navy as we procure the TACAIR capability for the 12 carriers for the future.

We have, in this process that I described, tried to scale down other things so that we could afford an aircraft procurement program that made sense. Although it is a little higher as an Aircraft Procurement Navy program, it allows us to fit it inside that constrained budget.

Another priority is the follow-on aircraft, the A/F-X. We have been working closely with the Air Force to develop a Joint Operational Requirements document which we have both signed off on that is the basis for A/F-X as we proceed into that joint development.

We are anxious to continue working with the Air Force on this. We would both like to find commonality as we see the F-22 come along and common components with the F-22, and we want to try to take advantage of this joint A-F/X development with the Air Force to the greatest extent we can.

Those two airplanes are extremely important to us. We made a decision, the beginning part of which you see in the FY 1994 budget, to start taking the A-6 aircraft out of our inventory. You see decommissioning of two A-6 squadrons in the FY 1994 budget and it is the lead-in to a Navy-recommended plan to take all A-6 aircraft out of inventory by FY 1999. That was a difficult decision.

Mr. Wilson. Those will be replaced by F/A-18s?

Admiral Owens. That is our intent, that the A-6s, as they come out of the inventory, would start to be filled first by the F/A-18s, the F/A-18E, and F's, as they come into the inventory about the turn of the century.

In the interim, we have made a decision about the F-14 program to trim it back to a force of about 210 aircraft, which will give us one squadron of F-14s per carrier to go with the F/A-18s. We will modify those squadrons of F-14s to have a limited air-to-ground capability. Those F–14 airplanes have a range that will substantiate about a 600-mile strike with a laser-guidance pod for precision guided bombs and some changes to the radar.

So we will have a laser pod on the F–14 that will allow it to drop two laser-guided bombs on target at a range of about 500 miles. If you really consider the way the Navy does strikes, we would always give high precedence to an EA–6B, an electronic jamming aircraft to fly in company with an airplane like the F–14.

When you look at that capability, that is not very different from what is represented by an F–117 capability. The F–14s are not stealth aircraft, but with the limited jamming that would come with an EA–6B on a combined strike mission, we feel we can continue that long-range strike capability out to 600 miles. The F–14 with smart munitions, the LGB, will provide significant capability on all carriers until at least 2010.

Our approach is this: To allow integration of a laser-guided bomb capability, and the F–14 will have capability to drop MK–80 series bombs. We think this is a prudent, affordable and efficient way to do our missions with this mix of aircraft.

Again to summarize, the F–14 in the interim, the F/A–18 transitioning from the C's and D's to the E's and F's and A/F–X as it comes on line the end of the first decade of the next century. So we are confident that this is the best thing we can do with our money. We think this is a viable capability.

We hear that some are concerned that we are giving up our long-range strike mission. I deny that. The F–14 will be a very effective airplane to do that. Also, we have come a long way in our stand-off munitions that can be launched from surface ships and submarines, in the form of Tomahawk, at ranges up to a thousand miles in numbers as large as hundreds, and the advent of high-technology stand-off cruise missiles from aircraft, which is a significant capability for us in the future.

For instance, all of the 50 tactical aircraft on the deck of an aircraft carrier come the turn of the century will have the ability to carry a SLAM P3I weapon. That is stand-off weapon derivative of the Harpoon which can be launched from an aircraft at a range of about a hundred-plus miles, and will have the capability to penetrate about three feet of concrete. It is guided through an anti-jam guidance circuit by either the aircraft that launched it, which is miles away, or another aircraft in the area.

We think that we can have a very credible standoff capability with all 50 of those tactical aircraft from the deck of the carrier that extends the strike range another hundred miles in front of those aircraft. That system of standoff weapons, coupled with these modifications to the F–14 program, gives us the ability to conduct a long-range strike mission as effectively and with less loss of life than we would have expected to do in the past.

As a father with a son who is at the Naval Academy who will be going into these platforms in the future, I feel more comfortable having him go into the airplanes I have talked about rather than the A–6 with its low kinetic energy, its lack of survivability and the kinds of threats we will face in the future and the age of the A–6, which will be 26 years of age on average.

We are confident that we have looked at all angles of the aircraft procurement accounts. We think we have done the best thing with this strategy; that we will protect this country's capability for the long term and are optimistic that this approach is the right way to go.

We think that the white water nature of the world, the uncertainty about what kind of a battle we will be facing next month let alone ten years from now is a strong argument in favor of multipurpose airplanes strike and fighters.

All fifty of those tactical airplanes on the decks of carriers will be the next century be multi-mission. That is an important element.

F-14 AIRCRAFT

Mr. YOUNG. Admiral, you mentioned the deep strike mission for the F-14. Could you tell us more about that and what it would do to allow the F-14s to be able to perform that mission?

Adrmiral OWENS. Yes, sir.

We are trying to do this in a prudent and affordable way. We think that means that when you view this in the context of just one of the elements of a long-range strike plan with the Tomahawks, for instance, from the surface ships and submarines and with the stand-off missiles in the form of the SLAM P3I that will be capable of being launched by the F/A-18, that the F-14 need not have a capability for a full variety of weapons.

We think the critical capability for it is the laser-guided bomb, which is very precise. Any of the MK-80 series 1000- or 2000-pound bombs with a laser kit on them can be dropped from the F-14. Also, the ability to fly 600 miles, and the ability to have the things that an F-14 has, and with some improvements to the electronics in the aircraft.

The ability to have the laser pod, of course, to allow us to drop the bombs and the capability with GPS and an inertial navigation system that will have to be put in the F-14 will give us the ability to deliver the LGBs and bombs, but the F-14 will not have a need to deliver the standoff weapons.

We will not undergo the expense and we do not recommend undergoing the expense to allow the F-14 to carry all of those weapons. We think the complementarity of the problem allows us to do it as I described as a more efficient and prudent measure.

Mr. YOUNG. Would you upgrade an F-14 with TF-30 engines in this new mode?

Admiral OWENS. As you know, the F-14As are the only aircraft that have not been upgraded. This mix would leave about 80—I don't have the exact number—of A's. We recognize that the engine is an issue. It is something we have looked at as we have looked at the affordability and the likelihood that we will trim down from well over 400 F-14s down to this lower number so the A's that we are left with will be the best ones, of course, and they will also have a lot of support.

As time goes on and as affordability is further investigated, we could very well come back with the F-14A's for a reengining request.

The cost would be about $800 million at this point. As we balance the requirements, we think we can safely apply those aircraft as they are, but the A's may need to be reengined in the future.

Mr. WILSON. We are talking about standoff weapons. There was a controversy over a weapon and there was some kind S&I investigation or something. What was that?

Admiral OWENS. Mr. Congressman, I am coming up blank.

[The information follows:]

A Navy program known as Fiber Optically Guided—Skipper (FOG-S) was cancelled in FY 1992 because of extremely poor test results (less than 50% success rate). It was determined that the technology was not mature or promising enough to pursue further development. The Naval Investigative Service in conjunction with the U.S. Attorney's office is conducting an investigation and the matter is before a Federal Grand Jury.

Mr. WILSON. There was another weapon and the reason I remember it was because it was a Texas contractor, but there was another weapon that was thought to be better, AIWS. Is that still alive?

Admiral OWENS. Yes, sir. That is alive in the form of what we call the Joint Stand-Off Weapon today. It is a weapon that is being developed jointly with the Air Force. We think it has a lot of potential as a joint development.

Mr. WILSON. That is not self-propelled?

Admiral OWENS. It has a glide capability. It has a very accurate capability that can be launched from high altitude and may allow a stand-off of as much as 25 miles depending on the altitude from which you launch it. That program is going well.

I can get you the specific details. I can't exactly recall except that the program is proceeding well and is being jointly supported by both the Navy and the Air Force.

This one is of particular interest to us because in the "context" of this document and our awareness of and dedication to supporting the troops in the battlefield and the marriage between the Navy and Marine Corps is sincere. We hardly even argue anymore. It is an element of what naval air is thinking about today, how to support those marriages.

AIWS will be the weapon that will bring on board the sensor-fused weapons. The Air Force has been aggressive in pursuing sensor-fused weapons for support in the battlefield. It is an autonomous weapon, once released from the delivery vehicle, several independently intelligent munitions will find enemy armored vehicles seek them out and be able to destroy an armored vehicle.

That weapon developed by the Air Force will be a part of JSOW and I think it is critical to us in support of our Marines ashore that we proceed with that weapon system and we are doing that.

There is one issue with that, that the explosives in the weapon are sensitive munitions. They have to be insensitive munitions to be on Navy and Marine Corps ships at sea and we are proceeding to remedy that problem for the explosives.

[The information follows:]

The Navy is the lead service for the Joint Standoff Weapon (JSOW). JSOW is a family of standoff weapons that will significantly enhance Navy and Air Force strike capability, while reducing logistic and training costs. The JSOW "truck" will be compatible with virtually every tactical aircraft and USAF bomber. It will have a range exceeding 40 nautical miles when delivered from high altitude. The baseline JSOW will carry BLU-97 submunitions and will reach Initial Operational Capability (IOC) in 1998. JSOW carrying the BLU-108 Sensor Fused Submunition will achieve IOC in 2001. A JSOW unitary variant that will have a terminal seeker and man-in-the-loop data link will IOC about 2001 also. Efforts to establish a program to make the Air Force BLU-108 submunition comply with Insensitive Munitions requirements are underway.

Dr. WHITMAN. I have some additional information concerning your earlier questions. The Skipper that you mentioned was an iron bomb with rocket assist worked on some years ago by the Naval Weapons Center at China Lake.

Referring to JSOW, we are in the middle of a joint——

Mr. WILSON. AIWS?

Dr. WHITMAN. We are in the middle of joint cost-effectiveness analysis with the Air Force which we will complete probably early next year to allow milestone decisions on the incorporation of Air Force submunition in the Navy variant and on P3I to JSOW. That is on track and there are substantial R&D funds for that in the Army and the Air Force.

Mr. WILSON. Mr. McDade?

SHIP SELF-DEFENSE

Mr. MCDADE. Thank you. It is a pleasure to see you. You have a difficult task to perform.

Admiral, let me direct your attention first to the question of an interest item of the Committee and particularly our friend the chairman, who has constantly talked to the Navy about ship self-defense, and my memory goes back to the U.S.S. Stark, and I am sure yours, too. We kind of use that as a benchmark of where we began worrying about the Navy's vulnerability.

We had testimony that there are something like 60 nations of the world that have developed cruise missiles. We were astonished at the figure.

Would you concur with that figure?

Admiral OWENS. At least that.

Mr. MCDADE. How many have them in anti-ship mode?

Admiral OWENS. Fifty countries, launched from aircraft or from ships or from submarines at sea.

Mr. MCDADE. We had conversations back and forth and directed the Secretary of Defense to formulate a plan to come up with a solution to the problem.

Nothing is fielded as yet. You are still in the R&D mode?

Admiral OWENS. Yes, but there have been a lot of elements of this system coming on line.

Mr. MCDADE. Would you describe it, Admiral?

Admiral OWENS. First I think you have been wise in your interest and your aggressiveness in pursuing this kind of capability and cooperative engagement for us is an important part of what has come to be understood as one of our greatest leverages as we look to the future.

The ability to cooperatively engage among platforms is something that we acknowledge and will proceed with as aggressively as possible. We are trying to do it prudently and quickly. There have been at sea tests with cooperating sea platforms, surface ships, but we have not had a cooperating air platform yet. The critical platform is the E–2C and the problem there is the computer in the E–2C that requires miniaturization.

We are proceeding aggressively with that program.

Mr. McDade. It needs an upgrade? It is not a total rebuild?

Admiral Owens. An upgrade: electronics miniaturization to make sure we can fit it in the airplane.

Mr. McDade. Is all the money in the budget to fully fund that work?

Admiral Owens. Yes, sir.

The aircraft IOC is not as early as we would like it. It is 1999, but we are proceeding as aggressively as possible.

Mr. McDade. Is that the same date that we would have a solution to this vulnerability problem that we have been talking about, 1999, or do we have to wait for the full upgrade of the Hawkeye?

Admiral Owens. That will be an IOC for that capability with the airplane.

Mr. McDade. Any other systems prior to that?

Admiral Owens. The ship systems have been demonstrated and should be well in place in time to allow the cooperative engagement scheme to come together.

Mr. McDade. When will the systems be in place?

Admiral Owens. 1996 to 1997, sir, for the ships, but the airplane comes in 1999. The R&D funding is in place to do that and the procurement funding in part to get us through the century is there.

It will require additional procurement funding as we go past IOC into all the systems being purchased.

Mr. McDade. There is nothing lacking in the R&D budget to attack this problem?

Admiral Owens. We think we have all the R&D money necessary. I will tell you though that we think there are many other promising elements to this.

The Committee staff has been working aggressively with us on this. We agree with the direction and are starting to see other things that we want to investigate as part of this. We are optimistic that there may be other parts of this equation that are important.

It could, for instance, involve—and this is not in our budget, but we think that in the case where we have amphibious ships or surface ships out by themselves without an aircraft carrier in the area, we have been talking about the possibility that we could have an LHD surface ship with a couple of Aegis cruisers or 963 destroyers and nuclear submarines deployed. They don't have an airborne, early warning system. It is possible that we can incorporate other platforms as part of the cooperative engagement scheme for defense of those ships. That could include something with a capable sensor system that is in the air like an airship.

So we are working carefully with R&D, with Mr. Reis in OSD to see if we can put together an advanced technology demonstration for an airship that could provide 24-hour-a-day coverage in that critical airborne cooperating unit for defense of the ships in an area.

Unless, as you know, you get something up in the sky you just can't see over the horizon for that cruise missile to protect all the ships and to allow cooperation and exchange of data among the ships. That is one area.

We think there is promise in that. There are several steps that need to be taken. We will come back to the possibility of looking at an advanced technology demonstration for an airship.

CENTURION SUBMARINE

Mr. McDade. We are glad you are working on it. It is a tough problem, but one we need to solve. A colleague, as we were going through the budget process stopped me on the Floor and brought up the question of the Centurion. There is about $400 million, I believe in the R&D budget for the new sub?

Admiral Owens. Yes, sir; that is right.

Mr. McDade. This is all in the context of a difficult budget, not just this year, but even worse in the outyears if the numbers we see are accurate.

The question becomes why is it necessary for the Navy to do R&D on a new submarine? We have how many attack subs out there?

Admiral Owens. I think we have 86 in inventory today.

Mr. McDade. We are going to scale back to how many?

Admiral Owens. Our plans are not blessed by OSD at this time, but we have started to take the submarine force down in size. Our recommendation is that we proceed to do that through the rest of this century and that the JCS requirement has been stated as ———.

Mr. McDade. Somewhere in that neighborhood. The 688 is without question the best in the world. You have done a superb job with it.

The question asked me is what threat is the Centurion being designed to counteract that exists? Why do we need to build a new sub if we have in hand the problem of controlling the seas, making sure that our nuclear subs are okay and that we are patrolling on station. How do you address that question?

Admiral Owens. Well, sir, the question is a very complex one, as you well know. I was the Sixth Fleet Commander before I came to this job. I can tell you that the threat that is out there today is not insignificant. The diesel problem is one that should not avoid us. The Kilos that are out there, the 209's—and there are hundreds of these in the world today. Some of them are in places that we would rather they not be.

The Kilos in Iran, there is one there, another coming this summer. There are Kilo subs in Algeria. I used to think these ships are not worthy of too much of our time, that they have to come up and snorkel every so often, that we would see them.

This is some of the most modern diesel technology in the world. Part of the advantage of the collapse of the Berlin Wall has been our ability to see these ships up close. I had a chance to go to sea on a Kilo. I was struck by the technology that the Russians put into these export diesel submarines. They have an anechoic coating and the equipment is double-mounted; in other words, you have a generator and it is mounted sound isolated from a bed plate and the bed plate is sound isolated from the ship.

When I talked to the captain about how often he snorkled, he said never more frequently than every six days. The fact that you can take a diesel submarine out and operate it much like a nuclear submarine for six days at a time shouldn't avoid our attention.

The ability of a ship like that in the hands of somebody like Saddam Hussein to hold us at risk——

Mr. McDade. Does not the 688 handle that threat?

Admiral Owens. That is a submarine that is the most capable nuclear submarine in the world today. It is getting very close though to the levels that we are seeing from the Akulas.

We, I think for the first time in the history of nuclear submarines, have come to a point where our 688's Improved are at about the same level of noise as the Akula class.

If you look at the 688 versus a quiet diesel, we start to have difficulty with that threat. So quietness continues to be important.

We think the quietness of the SSN–21 was an important development and that to build a smaller submarine with equal quietness is important. We think that is important in the littoral for shallow water operations for the ability to have a new communications suite so the submarine can be linked to the LHD, which is supporting amphibious operations in shallow water.

Mr. McDade. Could you not modernize the 688 rather than to development of a totally new boat and field a totally new fleet?

Admiral Owens. The 688's aren't as quiet as the SSN–21 or projected Centurions. The Centurion will be quiet, built for running at higher speeds at quiet levels equal to the *Seawolf* and has a mine detection capability that is applicable out there.

I suppose you could design a whole new approach to 688 to give it that, but I think if you did, you would call it Centurion.

Mr. McDade. Would it cost as much?

Admiral Owens. If you were to start today with development, the ship is about the same size as the Centurion. The reactor plant for the Centurion is in development now. The S9G is designed and will be, we think, the best nuclear reactor plant that the world has seen in terms of reliability, low level of maintenance, and that the ship will only have to be fueled at its commissioning and never again.

It will save us a lot of money in the power plants. We think the high tech, the proficiency and the shaping of Centurion for the future is an important element of our future capability and it is an important part of our industrial base so we proceed to continue to support the funding of the first Centurion in 1998.

We also think that submarine can have additional capabilities such as special forces insertion. We think this is a relevant part of this new whitewater world that we face.

Mr. McDade. Thank you.

Thank you, Mr. Chairman.

Mr. Wilson. Mr. Dicks.

NAVAL AVIATION

Mr. Dicks. Thank you, Mr. Chairman.

Welcome, Admiral and General. I am sorry I was not able to be here earlier to hear your presentation. I would like to ask you, Admiral, about naval aviation.

We were under the impression last year that the Navy finally had gotten its act together on where it wanted to go with naval aviation. Then all of a sudden we have this new initiative on the F–14 in the budget which I think has again caused considerable questions to be asked on the Hill about where the Navy is going on its aviation program.

I must say after what has happened on the A–12 and all the concerns about the Osprey and F/A–18s, can you tell me where this F–14 thing came from and why the Navy has made another change in its aviation program after it told the Congress that it finally had its act together and was going to give us a plan, that it would stay with and not change it? I don't understand this.

Admiral Owens. Mr. Congressman, we have not changed very much, I would say to you.

Mr. Dicks. But you have changed.

Admiral Owens. Yes, sir.

Mr. Dicks. Explain this new chapter.

Admiral Owens. We view this as an iteration of a Navy aviation plan to ensure for you that we can tell you that plan is affordable and prudent and that we have reacted to the new situation we face in the world today.

I talked about the A–6 and how we feel about its survivability and longevity as we look at the long term.

We think the A–6 is not a survivable airplane. It does not have maneuverability to allow us to be able to send our young people out in the airplane. It will be 26 years old on average.

Mr. Dicks. I am with you on that.

Admiral Owens. That is a change in our plan. It was necessary then to look at the systems that existed to allow us to maintain the continuance of that deep strike, that long interdiction capability and that we think comes from the already-established plans for Tomahawk and standoff air-launched missiles in the form of SLAM and SLAM P3I, which we think is a remarkable development.

Mr. Dicks. You have SLAM, Tomahawk, and what was the last one?

Admiral Owens. There is in the FY 1994 budget a SLAM preplanned product improvement development that we think will come at relatively low cost, will allow us to convert more of the Harpoon missiles in our inventory to allow a standoff from an aircraft of about 110 miles with an accuracy of about three meters and with a concrete penetrating capability of about——

Mr. Dicks. You are going to use these off the F–14 aircraft?

Admiral Owens. Off the F/A–18s only, sir, especially the E and F. The E and F's are important because they have the ability to bring back those weapons as well as the TSSAMs.

Mr. Dicks. You are going to put SLAM on the F/A–18?

Admiral Owens. SLAM and SLAM P3I. You can put four SLAM P3I on each F/A–18 E/F. That standoff capability is significant.

Those are low observable missiles. They have a good capability, are very accurate and it can be a critical element of strike planning.

At the same time, we have Tomahawk Block III and the baseline improvement program which will allow us by the turn of the century when A–6s are gone to be able to extend that reach by about a thousand miles with a Tomahawk.

Mr. DICKS. Both of those go to a fixed point. They are not smart weapons. In other words, they don't adjust and home in on the target?

Admiral OWENS. As presently designed, the Tomahawk baseline improvement program will not go to a moving target.

Mr. DICKS. SLAM doesn't either?

Admiral OWENS. No, but we think it has potential to do that with an anti-jam data link. The aircraft is guided to its target by either a launch aircraft or by another aircraft in the area from a range of about 100 miles which will allow it to stand-off outside air defenses.

Those are important additions to our long-range strike capability.

In addition, we think we need to have manned aircraft go to a range of about the A–6. Much of this was in the plan submitted last year and was the capability of F–14s to launch gravity bombs which they have the capability to do and importantly——

Mr. DICKS. Will those be smart?

Admiral OWENS. In the past as we have looked at the F–14, those have not been smart. But the change in the plan is the advent of a limited capability for the F–14 in fewer numbers—that is one squadron per aircraft carrier, fourteen airplanes to launch laser-guided bombs from the F–14, not SLAMs, not TSSAMs, not JSOW, but to include laser-guided bombs to allow——

Mr. DICKS. Do you have a weapon of choice there? What would be the laser bomb you would use or do you have to develop that?

Admiral OWENS. It is in our inventory today, was used in DESERT STORM, a MK–80 series bomb with laser kits on it. It comes in the form of a 500-pound bomb or a 1,000- or 2,000-pound bomb, the 82, 83, or 84. Those weapons can be accurately delivered then from a F–14 with a limited amount of funding given them to give the F–14 precision capability at ranges of 600 miles from the aircraft carrier.

We think that is an important capability. It can be done over the total program for about a billion and a half dollars.

Over the scope of the program that includes——

Mr. DICKS. How many F–14s will need to be modified?

Admiral OWENS. 210, but we would not reengine the A's. About 90 A's would not be reengined. About 90 of them would not be.

The F–14 comes in three varieties, the A's that have the TF–30 engine, those are the ones that require reengining. They are about 90.

Mr. DICKS. They are the ones that need the reengining?

Admiral OWENS. That is right. The B's and the D's don't need reengining.

Mr. DICKS. How many?

Admiral OWENS. Something in the area of 120. I will get you the exact number. That is a priority that we must address.

[The information follows:]

Of the 210 F–14s slated for the "Block 1" strike upgrade program, current plans call for all 54 F–14Ds and all 68 F–14Bs, which already incorporate the F110 upgraded engine, to be included. The remaining 88 aircraft would be F–14As, with the TF-30 engine installed. The Block 1 strike upgrade plan does not call for reengining these aircraft. However, the Navy will be reengining as many F–14A aircraft to the F–14B configuration as can be accomplished with the FY 1992 and FY 1993 Congressional appropriation plus-ups.

Mr. Dicks. This is to replace the A–6s, the long-range strike role?

Admiral Owens. It is a bridge for us as we transition out of the A–6s and into A/F–X at the end of the next century. That bridge is the combination of these F–14s, the system of standoff weapons that I described, and the F/A–18E. F–18 E and F that will start coming into our inventory and have a strike range of between 450 and 600 miles, depending on the load you want to put on it.

We think that F–14 capability with that laser-guided bomb load and with an EA–6 is not unlike an F–117 capability.

It obviously is not low observable, but if you have a limited jamming capability with it and LGB capability, you can fly 600 miles from a carrier, deliver laser-guided bombs and return to the carrier.

As I said earlier, I have a son who is at the Naval Academy and will join these people shortly. I would not want him to be in an A–6, but in an F/A–18E or F or in an F–14——

Mr. Dicks. Does F–14 give us day/night, all-weather capability?

Admiral Owens. In this mod package, improvements will give us an all-weather capability. It will not be a nap of the earth A–6 level capability where you can fly in at one or two hundred feet above the ground to a target, but it will allow us to go into a target adverse weather, day or night.

Mr. Dicks. Adding the 210 F–14s, we have those already. None of these have to procured; right?

Admiral Owens. That is right. We are not procuring F–14D's. The F–14 inventory is to be taken down from 450 to 251, of which 210 are the Block I strike upgrade. There is a savings of $1.2 billion in that. That money would be applied to make the remaining F–14s all they can be with this very limited strike capability.

F–18 PROGRAM

Mr. Dicks. Give me a quick rundown, F/A–18 E and F, what is the timing on that?

Admiral Owens. The F/A–18E and F IOC will be about the turn of the century. 2000 is what the IOC will be. It is an important airplane to us and we are proceeding as fast as we can.

Mr. Dicks. What is in the Navy's Budget request this year for that?

Admiral Owens. I will get you the exact number.

I think there is about $1.4 billion in the budget for R&D for F/A–18 E and F in FY 1994.

[The information follows:]

The FY 1994 President's budget contains $1,413,972M in RDT&E funding for F/A–18E/F.

Mr. Dicks. What is the total developmental cost?

Admiral Owens. Total R&D for the F/A–18E and F is about $5.6 billion.

A/F–X AIRCRAFT

Mr. Dicks. Now, tell me where we are now with the A/F–X?

Admiral Owens. Since we were last here to testify, the Navy and the Air Force have reached an agreement and both the Chief of Staff of the Air Force and the CNO have signed the Operational Requirements Document for the A/F–X. That is a Navy-Air Force airplane.

Mr. Dicks. What would this do for the Air Force again?

Admiral Owens. I think the A/F–X is a replacement for the F-15E Strike Eagle, a replacement for the F–117 and for the F–111s. A/F–X would be a follow-on intermediate range strike capability for the Air Force. This is a very central part of the new OSD bottom-up review that we are going through now, the whole issue of Navy-Air Force TACAIR.

Mr. Dicks. How are we doing on that?

Admiral Owens. We think we are doing great, sir.

Mr. Dicks. How much do we have in the budget this year for A/F–X?

Admiral Owens. $400 million.

Mr. Dicks. What is the IOC?

Admiral Owens. 2008.

Mr. Dicks. What is the total R&D budget for A/F–X?

Admiral Owens. I think it is $19.6 billion.

[The information follows:]

The total development estimate for AFX is $17.9 billion in FY 1991 dollars ($19.3 billion in FY 1994 dollars). This figure reflects notional schedule and cost estimates pending evaluation of D&V proposals, selection of specific contractors and designs, and Milestone I approval. It also represents a competitive prototype strategy for the D&V phase.

Dr. Whitman. It is about $22.8 billion in then year dollars.

Mr. Dicks. That is before you get into procurement?

Admiral Owens. Yes, sir.

Mr. Dicks. How many aircraft are we talking about procuring?

Dr. Whitman. 575 for the Navy and approximately 400 for the Air Force.

Mr. Dicks. The F/A–18 C and D—where does that fit into this?

Admiral Owens. We continue to procure F/A–18 C's and D's. There are 36 in the FY 1994 budget and we will continue to procure that airplane until we start funding the F/A–18 E and F for procurement, which is FY 1997. I think the first year procurement is for 6 airplanes.

Dr. Whitman. That would be the last year of procurement of the C and D's also, sir.

Mr. Dicks. Is the Marine Corps getting any of these, General?

General Krulak. Yes, sir.

[Clerk's note.—The following information was submitted subsequent to the hearing:]

The F/A–18C/D is the Marine Corps principal fighter attack aircraft. It proved its versatility as a true multi-role aircraft in Desert Storm. Marine F/A–18s conducted strikes against Baghdad, suppressed enemy air defenses, acted as airborne tactical and forward air controllers in Kuwait during most of the ground war, and also provided crucial close air support to the 1st and 2nd Marine Divisions. That kind of versatility and support is invaluable to the Marines on the ground. I strongly encourage continued F/A–18C/D procurement to meet our requirements. We need it.

General **Krulak**. Unlike Admiral Owens, who is a nuclear power officer, I am an infantry man. As a ground officer, what the E–F does for me in the littorals is during a very critical time, it provides an ability for that aircraft to have the endurance to remain over the battlefield to help me shape it and to provide close air support.

[Clerk's note.—The following information was submitted subsequent to the hearing:]

Two additional Marine Corps aviation programs also directly impact battlefield close air support. These are the AH–1 attack helicopter and the AV–8B Harrier aircraft.

We rely on the AH–1W to provide our Close-in Fire Support. Its anti-armor capabilities are truly impressive. In Southwest Asia they destroyed 97 tanks and 104 armored personnel carriers and vehicles. We seek to continue purchasing and modernizing our Cobras to meet our requirements under day/night and adverse weather conditions. The Night Targeting System (NTS) with its FLIR and laser target designator greatly expands the Cobra's operational capabilities. For example, Cobras currently rely on an external source (another aircraft or a forward air controller with a laser designator) to provide the laser designation required to employ its HELLFIRE missiles. As you can imagine, that involves a lot of coordination which takes time and can result in lost opportunities. NTS will provide the Cobra with an autonomous capability. I strongly encourage your continued support of our premier attack helicopter.

The AV–8B Harrier's unique characteristics allow it to be based virtually anywhere. This means that we can have it near the front lines and it can respond quickly to battlefield requirements. A few minutes may make all the difference in a ground commander's ability to take advantage of fleeting opportunities. The AV–8B Remanufacture program will convert Day Attack Harriers to the Night Attack/Radar configuration, incorporate several safety changes that will enhance survivability, reduce attrition, and extend aircraft service life. The program gives the Harrier an air-to-air capability which will provide the Amphibious Task Force with an increased air defense capability. The AV–8B Remanufacture Program will provide MAGTF commanders with responsive and highly effective VSTOL attack aircraft.

Mr. **Dicks**. That was a lesson learned in Iraq?

General **Krulak**. Absolutely.

Mr. **Dicks**. We could not achieve this with the short legs of the F/A–18s?

General **Krulak**. Yes, sir. We were able to have a situation where the Marine Corps was able to put in their expeditionary airfield (EAF) and run air off EAF's in some airports that were within the country.

In littoral warfare, you don't always have that right off, and here is a system that will have endurance to be overhead for me when I need it.

V–22

Mr. **Dicks**. V–22, where are we on that?

Admiral **Owens**. I would like to say a word about the V–22. The last time we were here, Navy was not as firm as we are this year in support of our Marines and the V–22 program. We are now. We have played a lot of wargames in the interim.

We have rationalized the lessons learned from the Gulf and are both firmly on board for the procurement of V–22 as the medium lift requirement for our Marines in the future.

Mr. **Dicks**. You were going to look at some other variety, an alternative to the V–22. What is the status on that program?

Admiral **Owens**. In formal terms, and there is a small amount of money in our budget to continue that, but it comes to conclusion in the form of the Cost and Operational Effectiveness Analysis that is completed this summer and it does include a possibility of other helicopter variants as a possible alternative. But having said that, as with each of the systems, as we proceed to find the requirement, we together have worked to try to determine what the best airplane if for our Marines and for our capability and we think that is the V–22.

General KRULAK. If I could put a stake in the ground today, it would be through the heart of the medium lift helicopter alternatives. The Marines also need heavy lift capability.

[The information follows:]

The CH–53E is the Corps' workhorse. It is the only aircraft that can satisfy our heavy lift requirements for the LAV, M–198 Howitzer and five-ton trucks. The current plan has the Department procuring 12 in FY94, 4 in FY95 with production line shut down in FY96. We need to continue to procure enough CH–53Es to ensure that we continue to satisfy operational requirements.

Mr. DICKS. We will take care of that.

Mr. WILSON. Mr. Visclosky.

Mr. VISCLOSKY. What is the alternative?

General KRULAK. The alternative to the V–22, sir, based upon some serious wargames that have been taking place over the last six months, the alternative is to go with something that does not have the capability that we believe, and I believe Admiral Owens will support it, to meet the requirement.

Admiral OWENS. We have to offer the caveat though that of course we are subject to our civilian leadership and we are undergoing this bottom-up review now in which we will represent the V–22 as we have described here, but the final decision on how we proceed with that program of course will come from the Secretary of Defense bottom-up review.

SHIP DEFENSE

Mr. VISCLOSKY. Following up on questioning by Mr. McDade, what improvements has the Navy actually made to its ships, subsequent to the Stark attack, to improve their self-defense capabilities?

Dr. WHITMAN. We have recently put together a new Program Executive Office focused almost totally on this issue. We have a series of four time-phased suites of equipment for increasingly more capable ships that would be installed over the future years.

Mr. VISCLOSKY. In a sequence of four installations?

Dr. WHITMAN. Four groups of ship classes starting from the very simple to the very complicated. We have operationally tested the most elementary of these as recently as early this year. We are doing a concept demonstration of the next most complicated version on an LSD this summer. These, in fact, consist of varying missions and integrations of existing missile system, sensors and display and decision systems for the commanding officer.

We are at sea, in fact, with a number of the constituents of self-defense systems of various kinds. The principal effort is on integrating these into a synergistic system that can handle the kinds of threats that we will see in the literal regions.

Mr. VISCLOSKY. In combination with aircraft? Aircraft gives you more distance?

Dr. WHITMAN. That is correct. We are providing both a robust self-defense capability for a ship that might be by itself and capabilities for ships to be able to share their mutual strengths.

Mr. VISCLOSKY. Has anything been fielded to date?

Dr. WHITMAN. We have fielded today missile systems.

Mr. VISCLOSKY. They were not present at the time of the Stark incident?

Dr. WHITMAN. We have fielded a system called RAIDS, a command and control system that supplies the commanding officer with a threat picture and recommendations for how he is to best use his on-board assets to react to it.

We have begun installation of the Rolling Airframe Missile, an effort specifically intended for cruise missile threats up to ranges of roughly four nautical miles and other programs are following close on the heels.

Admiral OWENS. We can give you a sheet with some of the numbers, but there has been a tremendous amount of actual installation of things on ships that are in support of the lessons learned from the Stark. For instance, the improved CIWS, has the capability to extend the elevation and improve the reliability. There have been many installations of that put on many varieties of our ships. We have fielded the Outlaw Bandit system ———.

Along with that will be the advent of a new EW system, the SLQ–32V5. We are installing the AN/SLQ–32 V5 on our active duty FFG–7s. That will provide an active counter-measure against a radar seeker. So with the ——— ship and with active counter-measure as a pair, this is a great capability for ship defense.

There have been several of those systems already installed in the FFG–7s, and we are proceeding apace to install additional systems now.

There are a number of other things we have done. We can give you numbers.

[The information follows:]

Navy is pursuing a wide range of upgrades and modifications across the entire Detect-Control-Engage spectrum to defeat both the current and emerging threat.

A focus of the ship self-defense effort in the development of a fully automatic, integrated combat system which is based on fully coordinated detection/control and softkill/hardkill engagement functions.

In the near-term, shipboard self-defense systems will install and integrate selected systems to enhance shipboard reaction time. System upgrades include:

CIWS Block 1 Baseline 0/1/2: Increase magazine and rate of fire.

CIWS Block 1 Baseline 3: Sensor upgrade and Higher Order Language computer

Rolling Airframe Missile (RAM): Short range self-defense missile will be put on all amphibious ships and some combatants.

Radar improvements: SPS–49 Medium PRF Upgrade (MPU) (Volume search) and SPQ–9 (Horizon search) improvements in target detection.

Electronic Warfare improvements: Upgrades to SLQ–32, Outlaw Bandit program, and decoys.

Maximizing total ship defense with multi-sensor integration and hardkill/softkill integration. Examples include:

SSDS Mk O (RAIDS): A tactical decision aid for the Tactical Action Officer/Commanding Officer

SSDS Mk 1: Integrates sensors, automates local C&C, directs weapons on fiber optic Local Area Networks. Demo in LSD–41 on 08 June 93

SSDS Mk 2: Evolutionary expansion of SSDS Mk 1 to ships with NATO Sea Sparrow missile system

Advanced capabilities will be needed to pace the threat. R&D efforts are being pursued to incorporate future science and technology developments into systems developments. Programs include:

Cooperative Engagement Capability
EO/IR technologies for both sensors and weapons
Advanced Integrated Electronic Warfare System (AIEWS)
Evolved Sea Sparrow like Missile (ESSM)

Current technology efforts in sensors include affordable radar for low RCS signature targets, target identification, and advanced IR sensor development.

Technology efforts in engagements include low altitude fusing, high energy density warheads, and potentially High Energy Laser (HEL).

Efforts in EW include precision ESM, advanced decoys, and active IR and microwave devices to defeat missile seekers.

Mr. Visclosky. For the record, if you could provide me with a list of explanations for the four classes of ships from most complex to least complex.

[The information follows:]

Ship Self Defense System (SSDS) MK-0 (Rapid Antiship cruise missile Integrated Defense System (RAIDS)): SSDS MK-0 (RAIDS) is a tactical decision aid for the Commanding Officer/Tactical Action Officer (CO/TAO) which provides auto-display of ASCM threats and ASCM launcher platforms, integration of active and passive sensor displays and coordination of existing terminal defense systems. SSDS MK-0 (RAIDS) is designated for DD 963 class ships until development of SSDS MK-2 becomes available. FFG 7 class ships will also be outfitted with SSDS MK-0. RAIDS has successfully completed formal developmental testing (DT) in USS JOHN HANCOCK (DD 981) and completed operational testing (OT) in USS JOHN RODGERS (DD 983) in March 1993. The OT Report will be delivered in time to assess a production decision as early as July 1993 starting with the DD 963 class.

Ship Self Defense System (SSDS) MK-1: SSDS MK-1 integrates sensors, automates local command and control, and assigns and directs weapons using a Survivable Adaptable Fault-Tolerant Embedded Network with Fiber Distributed Data Interface (SAFENET/FDDI) which employs distributive processing architecture. This concept will be demonstrated in USS WHIDBEY ISLAND (LSD 41) with a controlled firing exercise in early June 1993. The sensor suite consists of the AN/SPS49(V) Air Surveillance Radar, an Infrared Search and Track System (IRST), AN/SLQ-32 Countermeasures Set and two CIWS search and track radars. The weapons suite consists of the two CIWS gun mounts and Rolling Airframe Missile (RAM) system. The Multi-Sensor Integration (MSI) concept makes use of date from all sensors (radars, EO/IR, EW,) to generate optimized target tracking. SSDS MK-1 is designated for LSD 41, LSD 49, LHA 1, FFG 7, and L(X).

Ship Self Defense System (SSDS) MK-2: SSDS MK-2 will provide an evolutionary expansion of the SSDS MK-1 capabilities in ships which have the NATO Sea Sparrow Missile System (NSSMS) and Target Acquisition System (TAS) installed. The SSDS MK-2 will integrate the existing Combat Direction System (CDS) in these ships to bring in remote target information provided over data links and will use this data for self defense system cueing. Additional capabilities in hardkill/softkill integration are planned. SSDS MK-2 is designated for AOE 6, LHD 1, DD 963, and CVN 68 class ships.

Ship Self Defense System (SSDS) MK-3: SSDS MK-3 capabilities are under review, and will incorporate evolutionary changes from the MK-2 system and new combat system elements as developed. Current planning for the MK-3 system configuration includes an improved interceptor that has features such as multi-mode guidance, directional ordnance, and greater kinematic performance. Possible elements being investigated include: Evolved Sea Sparrow like Missile (ESSM), Advanced Integrated Electronic Warfare System (AIEWS), and a new Multi-Function Radar (MFR).

COOPERATIVE ENGAGEMENT

Mr. Visclosky. The Committee directed that "cooperative engagement"—a classified scheme by which many ships and aircraft share radar data to jointly protect each other—be fielded by 1996. Does the Navy plan to meet that date?

Admiral OWENS. In the form of a ship cooperative system, sir, that capability will be there, but I would be quick to add that the air cooperating unit is not going to be fielded in 1996. We regret that. We aggressively fund it. We would like it to be there in 1996, and are doing everything we can to make it come as quickly as possible.

The critical element is miniaturization of the computer for the E–2C aircraft and the difficulty of that and the long lead for that will not have it at initial operating capability until 1999. We proceed as aggressively as possible into this program with that as our goal.

Mr. VISCLOSKY. You would expect the E–2C to be part of this configuration by 1999?

Dr. WHITMAN. We are planning to have a demonstration of a surface ship incorporating some of the air capability at the end of this year. That would involve the Eisenhower battle group, two cruisers and a P–3 playing the constructive role of an E–2 with prototype CEC equipment on board.

Mr. VISCLOSKY. I share Mr. McDade's concern. When we had testimony about the number of potential countries with systems, it was a revelation in a manner of speaking.

Admiral OWENS. We certainly monitor that and we take it very seriously. A critical part of this defense in the future is the ability to detect with an array in the air a low-observable cruise missile. As you will know, the E–2C will not have that ability ever. It will have some ability as we get the block 2 into the E–2C, but that capability to get a radar in the air to be an active part of the cooperative engagement, the radar large enough and capable enough to detect low-observable cruise missiles is very difficult, which brings me back to my airship discussion because the only way you get a radar in the air that is large enough to detect low-observable cruise missiles, we think, is in an airship. That has a lot of cultural resistance. We have tried to discuss this with the Air Force with AWACS as the cooperating unit. AWACS does not have the capability for low-observable detection either and does not have the ability to incorporate this participating unit in cooperative engagement.

I wanted to mention the ability to have radar detect low-observable objects is very important for ship defense in the future. We don't have an answer to that right now. We are aggressively working on it.

Mr. VISCLOSKY. What is the airship you mentioned?

Admiral Owens. The Navy had an airship in mind in about 1989.

Mr. VISCLOSKY. Are you talking about an airplane?

Dr. WHITMAN. No, things like the Goodyear blimp.

Admiral OWENS. Airships of the size of maybe five times as large as the Goodyear blimp are the kind of things the Navy was looking at.

We need to be thinking about the technology of the radars that go into these things as one element.

Second is to have an illuminator in the airship to be the fire control for a cruiser, for instance, shooting missiles to allow extension of a cruiser or an FFG–7, for instance, and the ability of the radar to be large enough to see low-observable objects.

If we are concerned about the number of cruise missiles in the world, anti-ship cruise missiles, I say to you we must be concerned about the low-observable nature of those cruise missiles, and the answer is not there today in the E–2C or the AWACS or any other American surveillance system that will allow us to address that problem, so we must address that problem in addition to the architecture of cooperative engagement. And we are working on that.

Mr. VISCLOSKY. If the E–2C does not give that to you, what does it give you?

Admiral OWENS. That kind of information on non-low-observable targets, in other words, a standard airplane or a cruise missile that is not low observable, that is resistant to radar detection. But low observable objects today are proliferating.

Mr. VISCLOSKY. Was the missile that hit the Stark low observable?

Admiral OWENS. It was not. But the missiles that are out there today in many of these 50 or 60 countries are low observable, and it is a threat that we have to address.

The problem is much more than just getting a cooperative airplane in the air. We must have a radar in the air that allows us to detect low observable objects whether they are airplanes or cruise missiles. We are addressing that as a technology and an issue that pertains to all of us, especially as we address the littoral campaign that General Krulak and I are so deeply involved in.

SEALIFT PROGRAM

Mr. VISCLOSKY. So far, you have talked about the amphibious force and protection of ships in littoral waters. You have not talked about R&D efforts or the movement of people and things, giving us cargo capacity, increasing the speed by which we can move large amounts of oversized and outsized pieces of equipment.

In terms of providing our country with as much flexibility in sealift capability, what type of R&D are the Navy and DoD engaged in today?

Dr. WHITMAN. As you know, we are participating fully in the procurement of Sealift shipping under the auspices of the Strategic Sealift Fund. There is not a lot of R&D going on there. We are attempting to buy as much ready-made equipment and existing ship designs as possible, in some cases conversions from existing ships.

If you are speaking of over-the-beach amphibious assault—

Mr. VISCLOSKY. Getting an M1 tank from CONUS to someplace.

Dr. WHITMAN. We depend on prepositioned ships, RO–RO vehicles capable of carrying large cargo of that nature. We plan to buy roughly 20 roll-on/roll-off ships for that role for the Marine Corps and the Army. Procurements of these are presently just beginning.

Mr. VISCLOSKY. What about new propulsion systems to move these things more quickly? You are talking about using exiting systems. If you want to get from the continental United States to somewhere in the Middle East, my sense is nimbleness and quickness is a necessity for the future.

Dr. WHITMAN. There have been substantial studies about how much speed is worthwhile pursuing. Twenty-four knots is the number that came out recently in the Mobility Requirements

Study. We are doing a significant amount of research in advanced marine propulsion, looking at systems such as recuperative gas turbines for more efficiency. These are more oriented toward warship applications and are intended for first prototyping on planned flights of the DDG–51 class in the next decade or so.

There is a substantial effort under way under the auspices of ARPA and a larger national effort involving the Department of Commerce to investigate increasing the viability of commercial shipbuilding and the maritime industry of this country. We are participating as members of committees to determine the best course.

Mr. VISCLOSKY. Could you provide for the record in dollars, the cost of movement of people and things?

[The information follows:]

As I mentioned earlier, the Mobility Requirements Study (MRS) has determined that 24 knots is adequate for our new prepositioned ships and our new CONUS surge ships to move combat equipment anywhere in the world in sufficient time to handle expected contingencies. We are, however, engaged in a low level strategic sealift R&D effort to improve our capability for future sealift programs. Technologies developed would improve the cargo handling and propulsion efficiencies of sealift ships acquired after the turn of the century, as well as assist U.S. shipyards to improve their productivity in building sealift ships. The total proposed program funding is $49M over four years. Of this, $13M has been appropriated in FY 1993 and future funding requests will address the balance.

Mr. VISCLOSKY. Thank you, Mr. Chairman.

Mr. WILSON. Mr. Young.

MINE WARFARE

Mr. YOUNG. Thank you, Mr. Chairman. I had wanted to go into considerable detail on the V–22 but Mr. Dicks has preceded me and gotten some pretty positive statements on that issue, so let me go to the second issue.

As we reviewed the after-action reports of Desert Storm, one of the deficiencies we faced was inability to locate and to clear mines. The laying of the mine is relatively simple but to locate, detect and clear the mines is not all that simple.

In reading the prepared statements, I didn't read any comments about anything we are doing in R&D for mine detection or mine clearing. Could you comment on that? Is there something that you are doing that we should know about or are you not doing anything? What are we doing on the subject of mines?

Dr. WHITMAN. There is a growing program under way in research and development for mine detection and mine clearance. We have recently established a Program Executive Office whose entire focus is mine warfare. We are looking at a variety of mine-clearing and detection options which range all the way from various kinds of laser radars for detecting mines underwater and through brute force, bulk or sheet explosive techniques for access to beaches, for example.

The most difficult problem, frankly, is applying these techniques to the surf zone where turbidity of the water and the constant motion of the waves makes it very difficult to find the kinds of small anti-personnel and anti-boat mines that may be there.

The Marine Corps would like to have a podded system to be carried on an F/A–18 to do a beach reconnaissance. We are looking at advanced underwater systems which could swim in, locate mines and then provide the means for destroying them.

More traditionally, we have contracted for 14 ocean-going counter-mine vessels. We have under contract coastal mine vessels, having remote controlled underwater vehicles for detecting and localizing mines. We are working on increasing the accuracy and efficiency of mine-hunting sonar. Progress is very slow. It is a very difficult problem.

For 20 years I worked in designing mines, and I know how diabolically they can be conceived. There is a series of operational requirements that the Marine Corps have postulated for entry into defended beaches. They, in fact, have to do with the speed with which one can traverse a mined beach and whether or not one has to put a helicopter-borne element ashore to, in fact, assist in that operation.

General Krulak. I could go through a long litany. Let me say that as far as the Marine Corps is concerned, there is a strong feeling that there is good-faith effort being made there.

We mentioned the PEO, the operations officer of that outfit is a Marine colonel. The head of N–85 you heard mentioned is a Marine two-star general. For the first time, and it is thanks to the kinds of change in attitude, we feel we have a hand in that portion of our destiny that is involved with mine and counter-mine warfare.

I would agree the steps that are being taken are positive and we are working alongside them to solve some of the more difficult problems.

I could give you a whole litany of things we are doing, but will leave it at that.

Mr. Young. I am glad to hear you say this because most of the people I talked with about the problem of mines were Marines and they realized there was a denigration of their ability to move in Desert Storm.

General Krulak. One of the reasons General Mundy desired getting an officer of two-star or above rank to work with Admiral Owens was for that very reason. It was the realization coming out of Desert Shield and Storm that we had to have a hand in this destiny of mine warfare.

The actual detection, of course, is a problem and it is one we are working on.

Mr. Young. I am glad to know that you feel positive about this. It sounds good. If there is anything—would it be helpful if this committee included report language supporting the effort? Is there enough money in the budget to cover the programs that you have just described?

Admiral Owens. Sir, I think we are doing okay here. This is a majority of the Marine Corps and the Navy. I think for the first time we will tell you that sincerely.

General Krulak has looked at this in a more conceptual way so it fits together as a package. He ran wargames called "Operational Maneuver from the Sea" and that is a smart way of looking at mine warfare. It means that we will put a submarine, for instance, into an area where we would be expecting to make an amphibious landing and link that submarine with the ship and link that crew with an RPV possible to observe an expected amphibious landing area, to do it smart and with mobility.

The mobility part includes things like the V–22, things like the LCAC, and it also includes the Advanced Amphibious Assault Vehicle (AAAV) as part of the Marine bag of tricks to be operationally maneuverable from the sea.

We are trying to apply a little smarts to this in addition to the technical side that we have talked to you about in years past.

Mr. YOUNG. That is good, positive testimony, and I appreciate that.

Thank you.

A/F–X PROGRAM

Mr. DICKS. Just quickly, I wanted to go back. A recent Navy fact sheet to the committee indicates that the A/F–X is now to have only 40 percent of the internal bomb load, in pounds, that was planned for A–12. This internal bomb load is even less than that of an F–117, which today carries only two bombs. The aircraft can carry a much greater external bomb load, but that would compromise the aircraft's low observable features to some extent.

Why is the Navy apparently emphasizing fighter capabilities over bomber capabilities in the A/F–X program?

Dr. WHITMAN. If I am not mistaken, the F–117 could carry two 2,000 bombs internally, and that is what we are planning for the A/F–X.

The A/F–X can carry substantial additional external carriage. While we admit that will diminish its low-observable characteristics, we intend to use that capability only when air defense suppression has had its effect.

Mr. DICKS. So you can't lead—you are counting on B–52 or the Air Force to go in and do the heavy work for you and take care of air defenses, or are you going to use your SLAM or Tomahawk?

Dr. WHITMAN. I believe that for initial strikes we would use the A/F–X carrying two internal 2,000-pound bombs, GBU–24, which makes it more effective than the F–117 which has two GBU–27, minimal avionics and no self defense capability.

Admiral OWENS. We feel this is an airplane with deeper interdiction capability, that it will definitely give the battle group the capability to insert itself low-observable——

Mr. DICKS. Why the reduction from the A–12?

Admiral OWENS. When A–12 was designed, it was a different kind of world, a little bit more oriented to the kinds of major strike missions at long ranges that might require stealth with a lot of weapons.

We are more focused now on a contingency crisis world, and faced with a lot more of the unknown out there. We may face next week Yugoslavia, or next year a different kind of battle somewhere else in the world, so multiple-mission aircraft are important.

Mr. DICKS. That sounds like the F/A–18E and F. How would you distinguish these two aircraft? The F/A–18 has been criticized for trying to be everything and multi-missioned you never get the long-range capability for the great fighter capability.

Are we going to have two planes with similar characteristics? What do we need A/F–X for if it is only going to have this limited capability?

Admiral OWENS. That would be a 360-degree, multiple stealth aircraft. The others are not. It will have internal carriage of two 2,000-precision bombs or SLAM, or TSSAM. The F/A–18E and F will not. The E and F will carry the same weapons, but not with low observability 360 degrees. The A/F–X will fly 600 miles unrefueled in the most challenging of flight profiles, the others will not.

We think that the capability of the A/F–X is an important element of our future. That ability to strike in the low-observable mode is very important to us. It all fits together in a complementary way. You could see that the A/F–X with this capability, coupled with the others, coupled with Tomahawk, with anti-jam data links launched from a thousand miles away could be a potential strike capability, very versatile, and we think it all fits together and the A/F–X, we think, is the right kind of design for us and apparently the Air Force thought the same, since we were able to come to grips with a common agreed operational requirements document that addressed these very issues.

Mr. DICKS. Mr. Darden.

TRIDENT MISSILE

Mr. DARDEN. Dr. Whitman, I assume that in spite of all the diminution in the threat and the changes we have seen throughout the world in the past two years that we still are very serious about maintaining our sea deterrent, and specifically the Trident II submarine equipped with the D–5 missile.

How much is your request for a flight test program this year for that missile? And two, I understand there were problems several years ago and have those problems essentially been fixed now?

Dr. WHITMAN. To my knowledge, they have been fixed. We are requesting this year $1.1 billion in WPN for 24 D–5 missiles. I don't have the figures for the RDT&E. I can provide them.

[The information follows:]

For fiscal year 1992 through FY 1994 there are no funds programmed in RDT&EN to support the TRIDENT II (D-5) flight test program. The development flight test program funded by RDT&EN ended in FY 1990 with the completion of nineteen development flight tests conducted from a land based flat pad at Cape Canaveral, FL, and nine Performance Evaluation Missiles (PEM) flight tests which are development missiles launched from the TRIDENT submarine.

Mr. DARDEN. One point four billion dollars is the total——

Dr. WHITMAN. One point one billion dollars for procurement of 24 missiles.

Mr. DARDEN. What about the amount of money for the flight testing—I assume you have money in for flight testing of the missiles?

Dr. WHITMAN. Yes, sir, I believe we do. I don't have those numbers handy.

Admiral OWENS. I don't have those numbers. But as you mentioned, we had some difficulties with the reliability of D–5 several years ago. Since then it has been one of the most successful weapon programs and stands at the pinnacle of our ability to field a reliable missile system.

As a result of that, we have scaled back the number of missiles necessary as test vehicles because the reliability rate has been so high in the entire Trident weapon system. We have scaled back from ——— missiles per year.

I will verify those for you.

[The information follows:]

The number of Follow-on CINC Evaluation Tests (FCETs) was reduced from ———. This reduction was due in part to an observed reliability of TRIDENT II during the CINC Evaluation Test (CET) program of ——— thus requiring fewer test flights to detect a change from the higher reliability. Additional factors supporting the reduction in the size of the FCET program include the following: strategic environment, better defined CJCS guidelines for missile operational testing and cost savings.

The D-5 missile fly-away unit cost, funded in WPN, is approximately $20-25 million, depending on the fiscal year the missile was procured. Conduct of new construction Demonstration and Shakedown Operations (DASOs) is SCN funded while conduct of overhaul DASOs and CETs/FCETs are O&MN funded. The majority of the costs to perform missile flight tests are fixed test range support costs including support of the range ships. These efforts and functions must be available to provide flight test capability and support whether there are one or multiple flight tests in a given year—therefore it is inappropriate to apply these costs to a specific missile firing. The variable flight test support costs are approximately $2M per test missile which represents the non-fixed portion of a flight test (i.e., surface ship operations under Full Operating Status vice Restricted Operating Status, aircraft support and range support required for missile tracking, and flight test analysis effort (not always performed in the same year as the firing)).

Mr. Darden. ——— missiles for the flight test?

Admiral Owens. I believe that is right.

Mr. Darden. Do you recall, roughly, how many flight tests were done last year?

Admiral Owens. I am sorry, sir, I cannot recall that, but we will get that number for you.

[The information follows:]

The D-5 flight test program for FY 1992-FY 1994 is as follows:

	1992	1993	1994
DASO	2	Deleted	Deleted
CET	20		
FCET		Deleted	Deleted

The D-5 flight test program for FY 1992 through FY 1994 includes DASO flight tests which are designed to certify individual SSBNs and crews after new construction or overhaul. CETs and FCETs are necessary to satisfy the CJCS requirements for confidence in operational reliability and accuracy performance.

General Krulak. I was riding the USS Tennessee last week and I know they had three successful launches. The ship is still excited about it.

Mr. Darden. As far as you know, the program is functioning well and is actually being scaled back, I assume based on the reliable testing of the missiles?

Admiral Owens. Yes, sir.

A/F-X PROGRAM

Mr. Dicks. The Armed Services Committee has required you to go to two contractors on the A/F-X. Is that the reason why the cost has gone from $14.3 billion and an IOC of 2005 to $22.8 billion and an IOC of 2008?

Dr. WHITMAN. That is part of the reason.

Mr. DICKS. There appears to have been a change. Is that a mistake?

Dr. WHITMAN. The Navy position hitherto was that a competitive DEMVAL was not required. We still believe that but recognize that there are pros and cons. In a sense a competitive DEMVAL relieves you of the possibility that a single contractor could leave you in the lurch. On the other hand, a single contractor would allow us to devote all our attention to him. In fact, we could save some time in the competitive process.

Mr. DICKS. How much would you save if you didn't have to do that?

Dr. WHITMAN. We believe it would be in the neighborhood of $2 billion.

Mr. DICKS. That is $2 billion overall or $2 billion this year?

Dr. WHITMAN. Overall.

Mr. DICKS. How much in 1994?

Dr. WHITMAN. I don't have a number for that, sir.

Mr. DICKS. Provide for the record a figure for 1994.

[The information follows:]

The Navy could save between $175 to $187 million in FY 1994, in the event the AFX program is allowed to award a single Demonstration and Validation (D&V) contract rather than the Congressionally mandated dual contractors. The exact amount is dependent on evaluation of proposals prior to Milestone I and selection of specific D&V contractors and designs.

SSN-21

Mr. DICKS. We have a lot more questions. Admiral, do you think we ought to build three Seawolfs for industrial-base purposes?

Admiral OWENS. You are asking my personal opinion?

Mr. DICKS. Personal and professional.

Admiral OWENS. You would expect me to say and I will, we are involved in the bottom-up review, and that is one of the areas. As a nuclear submariner, and a person who has watched this for a long time, there is no doubt in my mind we need to continue the industrial base; that it is wrong to shut it down and expect that we will ever start building nuclear submarines again.

Therefore, it is necessary to continue the submarine industrial base at a minimum rate until we get to the point where we are building the Centurions. Therefore, if I understand the industrial base situation properly, and looking at the kinds of things we need to do to keep it going, I think that one additional SSN-21 is the right thing to do in FY 1995 or FY 1996.

Mr. DICKS. Until we get the Centurion, in an effort to preserve the industrial base, it is better to do that than go with the 688s.

Admiral OWENS. Yes, because there has been a lot of advanced procurement. If you decided to go with 688's that would be wasted. The analysis shows that you probably require two 688s and none of that has been procured, so it is new procurement, maybe more than one ship.

The best way to proceed is with one SSN-21 followed with a building program at a low rate——

Mr. Dicks. What would you need in the budget to preserve that option?

Admiral Owens. We are okay with the budget as it is. The real issue will be in FY 1995 or FY 1996 and that is what we are addressing now with the bottom-up review.

Mr. Dicks. We will be waiting with anticipation for the outcome. We have already cut all the money but now we are going to get the plan, right? Is that the way it works?

Dr. Whitman. As you know, there was $540 million appropriated for long lead.

Mr. Dicks. A third?

Dr. Whitman. Not necessarily a third.

Mr. Dicks. Long lead for what?

Dr. Whitman. The plan——

Mr. Dicks. Will that amount of money cover the option for a third Seawolf this year?

Dr. Whitman. It would get us started.

Mr. Dicks. For the record, if Congress decided to go with a third, would there be any need to adjust the budget in 1994?

[The information follows:]

One of the options for maintaining the submarine industrial base under review within the Department of Defense is the inclusion of a third SEAWOLF class submarine in the budget. It is not anticipated that this would require changes in the FY 1994 budget request.

Mr. Dicks. Thank you for a very good hearing. You did a very good job, Admiral Owens. There will be additional questions for the record.

The Committee will recess briefly before starting the next hearing.

[Clerks' note.—Questions submitted by Mr. Sabo and the answers thereto follow:]

ADVANCED ELECTROTHERMAL CHEMICAL GUN DEVELOPMENT

Question. This subcommittee has been very supportive of efforts throughout the Department to conduct research into Electrothermal-Chemical (ETC) gun technologies. Last year, for example, we added funds to several program elements to allow research to continue at a prudent pace. I also understand that both the Chief of Naval Operations and the Deputy Director of Research & Engineering have expressed support for this technology and its application to the Naval Surface Fire Support mission, in general, and the 5″ gun, in particular.

Question. What are the Navy's plans for pursuing ETC technology in FY 1994 and beyond?

Answer. The Navy is currently conducting a Balanced Technology Initiative (BTI) study with a 60mm Electrothermal Chemical (ETC) gun that has application in the development of a 5″ ETC prototype. The 60mm gun is undergoing test firings at NSWC Dahlgren this summer and the program will complete by the end of FY 1993. Also, Navy is pursuing a four-year, joint project with the Defense Nuclear Agency (DNA) to develop a five-inch ETC gun with potential ranges in excess of 50 nautical miles. While ETC gun has a potential application in Naval Surface Fire Support (NSFS), the joint

Navy-DNA project is being planned independent of the NSFS Cost and Effectiveness Analysis currently underway.

Question. I understand that the Defense Nuclear Agency has requested funds for ETC work in FY 1994, but that the Navy has not asked for any money to continue work on the 5″ gun demonstrator. Why not? Does the Navy have any plans for continuing this work? If so, how will it be funded?

Answer. A Congressionally mandated Memorandum of Agreement between Navy and the Defense Nuclear Agency (DNA) has been initiated. This agreement establishes a joint DNA-Navy Advanced Technology Demonstration Program to develop ETC modifications to the Navy's MK 45 5″ 54 caliber gun, complete the development of an ETC cartridge case and perform a series of tests with insensitive propellants. A prototype power system will also be designed and built to demonstrate performance characteristics and determine suitability for shipboard integration into a DDG size combatant. This program builds upon and formalizes ongoing cooperative efforts related to advanced electric gun technologies and pulsed power applications at DNA and the Naval Sea Systems Command.

Navy has agreed to jointly fund this program, beginning with a commitment of $8.5M submitted as part of the FY 1993 Omnibus reprogramming. The source of additional funding for FY 1995 through FY 1997, targeted at $41M, is under review.

ADVANCED SUBMARINE TECHNOLOGY

Question. I have been told that the Advanced Research Projects Agency has transferred several of the advanced submarine technology programs to the Navy. Can you provide the Subcommittee with a summary of your FY 1994 program? What funds have you included in the five-year defense plan?

Answer. Transitions from the Advanced Research Projects Agency (ARPA) advanced submarine technology program are primarily funded from within the Advanced Submarine Systems Development Program Element (PE 0603561N). Within this Program Element, the Advanced Submarine Systems Development Project (F2033) supports future developments that include projects transitioned from ARPA, the Navy technology base, and industry. $6.2 million are budgeted in this project for four ARPA transitions: hydrodynamics simulations; shaftless pump; electric drive; and an advanced material propulsor. Funding for later years is still in review within the Department of Defense. In addition, efforts on several ARPA projects are planned as NAS related technologies. These projects include non-acoustic (EM) silencing; hull dynamic strength; ARPA radiated noise projects F and P, enhanced tube condenser; and non-penetrating periscope removal/restoration. $22 million are budgeted for these projects in FY 1994.

Question. Do you anticipate utilizing any of this technology on the new Centurion submarine?

Answer. Several Advanced Submarine Technology Program Efforts are under consideration for the New Attack Submarine design. Six projects that represent enhanced design capabilities or R&D test assets are being used to lower program risk, developmental concurrency, and development cost. These projects include the newly established Hydrodynamics Technology Center, a hydrodynamics design work station, structural acoustic initiatives, a laser flow field measurement system, an enhancement to the ratio controlled submarine model, and a design for an integrated signature measurement system. There are six projects being pursued for use in onboard systems. These include four unclassified projects: non-penetrating periscope removal/restoration; an enhanced tube steam condenser; hull dynamic strength; and non-acoustic (EM) silencing. In addition, there are two classified signature control technologies (projects P and F) that will be incorporated in the design if required to meet the signature goals of the platform.

F-14 DIGITAL FLIGHT CONTROL SYSTEM

Question. Last year, there was some controversy over the Navy's decision to use Foreign Comparative Testing (FCT) money to develop and test a new, foreign-made, digital flight control (DFC) system for the F-14. There was some concern that the Navy's use of FCT funds unfairly kept U.S. firms from competing for the contract. In the end, Congress decided to allow the Navy to complete DFC testing, but require a competition for the production phase which would be limited to U.S. manufacturers. Where does the F-14 DFC test program stand?

Answer. The DFCS program is on schedule. Preliminary Design Review (PDR) of the hardware was completed in September 1992 and the Critical Design Review (CDR) will be completed in May 1993. Software PDR and CDR are scheduled for July and October 1993, respectively. First flight test hardware delivery is scheduled for January 1994 with flight test starting in July 1994.

Question. Is there any money in the FY94 budget for this program?

Answer. The FY 1994 budget has $6.065 million of Foreign Comparative Testing funding and $1.937 million of Navy modification funding.

Question. When do you project initiating a competition for production, and does the Navy expect any problems limiting the work to U.S. producers?

Answer. Competition for production will be initiated following successful completion of flight tests in FY 1994. The Navy plans to complete the effort among all responsible sources, as required in the Competition in Contracting Act (CICA). Regarding limiting the production effort to U.S. firms, CICA allows for exemptions for other than full and open competition for the following reasons: National security, Industrial mobilization, International agreement, and as authorized or required by statute. However, none of the above exemptions apply in this instance.

[CLERK'S NOTE.—End of questions submitted by Mr. Sabo. Questions submitted by Mr. Livingston and the answers thereto follow.]

THEATER MISSILE DEFENSE

Question. While I am not encouraged about the FY 1994 allocation (75 million) for the Brilliant Pebbles part of the SDI request

(3.76 billion), I am happy to see that Navy TMD for FY 1994 is allocated $258 million. Explain the increase.

Answer. The currently allocated $258M for Navy TBMD in FY 1994 includes $13M for Marine Corps TBMD effort. The allocation of the remaining $243M to Sea-Based TBMD efforts will provide increased funding to the lower tier program (Aegis and Standard Missile modifications) as well as funding to support a more robust upper tier program. This program will consist of the continuation of the TERRIER (missile) LEAP Technology Demonstration, initiation of a Standard Missile/LEAP Advanced Technology Demonstration, conduct of studies looking at identification and resolution of issues with integration of the Theater High Altitude Air Defense (THAAD) missile in a sea-based architecture, and conduct of system engineering efforts and a Cost and Operational Effectiveness Analysis (COEA) to support an upper tier Milestone I decision in FY 1995.

Question. Last year, Assistant Secretary Cann testified before this Subcommittee that the FY 1993 request allocated approximately $19 million to Navy TMD, but that additional funding up to a total of $60 million, would be needed to take care of the Navy effort in FY 1993. This Subcommittee and Congress encouraged the Defense Dept. to provide additional resources to the Navy TMD program. What was the amount finally allocated to Navy TMD for FY 1993? Was it $90 million?

Answer. The navy has received FY 1993 funding in the amount of $90M to support the TBMD effort.

Question. Based on the work in this area thus far, is the Navy finding that a ship based theater missile defense system can be deployed more quickly than other systems (land or space based) currently being developed?

Answer. With requested levels of funding the Navy could provide a lower tier defense based upon upgrades to the Aegis Weapon System and Standard Missile-2 Block IV in 1999. The development of that system would allow fielding of a User Operational Evaluation System (UOES), an operational prototype based upon the same system modification in 1996/1997. Also with requested funding levels, the Navy could provide an upper tier contingency capability based upon Lightweight Exo-Atmospheric Projectile (LEAP) technology that could be fielded in event of a crisis in 1999. The same requested funding level could lead to acquisition of an integrated upper tier system in the post 2000 time frame.

Question. How does the Navy TMD effort compare in costs to other systems?

Answer. While all of the TBMD systems being considered have different attributes and capabilities, it appears that based upon expected performance costs for Navy systems are comparable with those of other systems being considered. We are capitalizing on the prior investment of more than $40 Billion in the AEGIS fleet of some 50 cruisers and destroyers.

Question. For the record provide an update to the detailed explanation on the Navy TMD provided by the Navy in last year's testimony, Page 146, Part 6, Department of Defense Appropriations for 1993 hearing volume from the House Subcommittee on Defense.

Answer. The technical and programmatic approach provided to the Committee supporting the FY 1993 budget have not changed. Requested Navy funding has been adjusted as follows:

Fiscal year:	*Total TBMD*
1994	253.038
1995	567.652
1996	669.864
1997	711.595
1998	808.092
1999	846.856

Question. For the record, how has the program office and allocation of funds to the Navy TMD changed, if it has, from the description provided by Assistant Secretary Cann last year in hearing volume part 6, page 146?

Answer. The structure of the Navy TBMD office has not been changed from the description provided in the FY 1993 testimony. Increase in funding levels is a result of (a) a better definition and understanding of the technical approach to the sea-based lower tier program and (b) the inclusion of a sea-based upper tier system.

NAVAL BIODYNAMICS LABORATORY

Question. Last year, the Defense Appropriations Subcommittees approved $9.064 million in two "PE" lines for the Naval Biodynamics Lab. Of this amount, $4,064,000 was provided specifically for operations at the Lab, and the remaining $5 million was provided for a collaborative research effort for the establishment of an Advanced Marine Technology Center.

Provide a detailed status of the disposition, thus far, of the FY 93 funding by PE line.

Answer. The $5 million earmarked for collaborative research on Advanced Marine Technology was appropriated to PE 0603216N. The money was delayed six months in its arrival at the Navy Comptroller by OSD rescision. In March 1993, the funds were available to the Navy in PE 0603216N. The OPNAV program sponsor of PE 0603216N requested that the Navy Comptroller return the funds to the OSD Comptroller because the funds were for a purpose (Advanced Marine Technology) which is incompatible with the PE's purpose (Aircrew Systems Technology). The funds were returned to the OSD Comptroller, pending identification of a more appropriate Navy PE. During April 1993 the Navy Comptroller searched for an appropriate Navy PE. The $5 million was reprogrammed to PE 0603706N (titled Medical Development) managed by the Naval Medical Research and Development Command on May 13. A rationale for this choice is that Naval Biodynamics Laboratory is subordinate in the Navy Chain of Command to Naval Medical Research and Development Command.

An additional $1 million appropriated to PE 0603216N for the Naval Biodynamics Laboratory is being withheld from Naval Medical Research and Development Command by the OSD Comptroller. An additional $.253 million was removed for "3% general reduction," $.021 million for "travel reduction," and $.047 million for "inflation estimate reduction" in response to Congressional language. A temporary reduction of $.01 million was made by Office of Naval Research for Small Business Innovation Research; this $.01

million will be forwarded to Naval Biodynamics Laboratory as soon as it is reinstated. All remaining funds in PE 0603216N ($2.088 million) provided to Naval Medical Research and Development Command for Naval Biodynamics Laboratory have been distributed to the Laboratory.

Naval Medical Research and Development Command provided the Naval Biodynamics Laboratory $.345 million from PE 0603706N Project M0096 in FY93 for research on the personnel effects of ship motion.

Question. What are the Navy's plans for the FY93 funds that have not been allocated thus far?

Answer. The entire amount appropriated to PE 0603216N and made available to Naval Medical Research and Development Command ($3.098 million) not associated with establishment of an Advanced Marine Technology Center will be provided to the Naval Biodynamics Laboratory. The $5 million provided for a collaborative research effort and establishment of the Center will be divided between the collaborators: $4.5 million for the University and $.5 million for the Naval Biodynamics Laboratory. The funds allocated to the University will be conveyed through the Office of Naval Research. Office of Naval Research will designate a Scientific Officer for technical oversight of the establishment of an Advanced Marine Technology Center and the collaborative research effort with Naval Biodynamics Laboratory.

Question: Provide a breakdown, by PE line, of the request for the Lab in FY94.

Answer:

[Dollars in thousands]

Performance evaluation:	*FY94 Navy Request*
0603216N (Aircrew Systems Technology)	$1,825
0603706N (Medical Development)	345
Advanced Marine Technology Center	0
Total	2,170

Question. What funding in FY94 would be required, by PE line, to maintain the level of effort at the Lab and for the collaborative effort?

Answer:

[Dollars in thousands]

Performance evaluation:	*FY94 Navy Request*
0603216N (Aircrew Systems Technology)	$3,300
0603706N (Medical Development)	705
Advanced Marine Technology Center	0
Total	4,005

Funding at these levels will enable the Laboratory to continue to conduct research. Under PE 0603706N (Project: Protection of Naval Personnel from Motion Sickness and Other Adverse Motion Efforts) the following can be accomplished:

a. Extend and complete cognitive/psychomotor test development

b. Validate tests in Ship Motion Simulator and at-sea

c. Initiative translation of performance test results into ship design criteria

d. Complete survey of LCAC personnel and initial phase in transitioning motion sickness prevention program to the fleet

Funding at these levels under PE 0603216N will enable the following:

a. Develop finite element anatomically based head/neck injury model to predict injury risk of new helmet systems and other aviation equipment

b. Develop kinematic data error analysis model to refine database to standardize extensive library of kinematic data

c. Develop physiological (EKG/EEG/SEP) injury model

d. Complete first female volunteer tests series to study the effects of impact acceleration forces

PE 0603706N—Advanced Marine Technology

Since funding for the Advanced Marine Technology Center has not been received, it is difficult to project unanticipated FY94 costs. As stated above, FY93 funds were to support a two-year program.

Question. What is the status of Navy and Defense Department efforts to consolidate labs, i.e. Project Reliance, etc?

Answer. The Naval Medical Research and Development Command is involved only in the consolidation or collocation of medical laboratories and not other R&D facilities involved in project Reliance. Hence we can comment only on the status of the consolidation or collocation of Navy Medical R&D laboratories.

There are seven Biomedical R&D programs being relocated as part of project Reliance; five were incorporated into the Base Realignment and Closure Act of 1992. These are Infectious Diseases from the Naval Medical Research Institute in Bethesda, MD to the Walter Reed Army Institute of Research (WRAIR); Blood R&D from the Letterman Army Institute of Research (LAIR), San Francisco, CA to the Naval Medical Research Institute, Bethesda, MD; Bioeffects of Electromagnetic Radiation effort from the Naval Aerospace Medical Research Laboratory, Pensacola, FL and WRAIR to Brooks Air Force Base, San Antonio, TX; and Army Dental Research from Ft Meade, MD to the Naval Dental Research Institute, Great Lakes, IL. Several of these are well into the planning stage, some are underway and it is anticipated all will be completed by FY 97.

The Army Surgical research program is being relocated to Ft Sam Houston, San Antonio from LAIR and the Army Toxicology program is currently being relocated from Ft Detrick, MD to Wright Patterson Air Force Base, Dayton, OH. The Navy Toxicology effort has been at Wright Patterson for over 15 years. The Army Biodynamics program at Ft Rucker, AL is being relocated to Wright Patterson but because of Congressional interest, the Navy effort has remained at the Navy Biodynamic Laboratory in New Orleans, LA.

With the exception of Biodynamics, the original intent of project Reliance to strengthen Biomedical R&D programs through appropriate consolidation or collocation is progressing.

[Clerk's note.—End of questions submitted by Mr. Livingston. Questions submitted by Mr. Skeen and the answers thereto follow:]

DEFENSE DOWNSIZING

Question. While we await the Secretary's review and subsequent report, would you discuss for the Committee your views as to how the Secretary will proceed and how well—in your opinion—future Defense requests will treat RDT&E budgets in the Navy?

Answer. Service RDT&E programs should fare well in the Secretary's Bottom-up Review. The level of RDT&E requested in the FY94 President's budget is the correct amount for where we are today. Certainly, as the Bottom-Up Review produces results, RDT&E funding will change in accordance with decisions made on specific programs.

Strong efforts will continue in science & technology, aimed at providing long-term future capabilities and ensuring our technological superiority against a wide-range of potential and highly uncertain threats. R&D support of acquisition programs will continue where required in order to modernize and maintain force levels at the levels decided upon in the Bottom-Up Review.

Question. Will future defense downsizing proposals adversely affect the RDT&E budget, and if so, in what major technological areas?

Answer. Downsizing will certainly affect the Navy RDT&E budget, and this fiscal pressure demands that we shed internal excess RDT&E infrastructure and consolidate or eliminate redundant in-house efforts. As we do this, we will continue to rely on the civilian sector as the primary source of defense innovation, and take advantage of the intelligent application of commercial technology.

Within DoD, Navy labs and warfare centers will continue to focus on Navy-unique areas (e.g., Ocean Sciences), while maintaining our in-house ability to initiate R&D efforts to respond to emergent fleet needs. These consolidations and priorities formed the basis of the 1991 DON DRT&E, Engineering, & Fleet Support Activities Consolidation Plan.

As discussed in "From the Sea . . .", technological areas such as deep ocean ASW will receive reduced emphasis, while littoral issues, such as shallow water ASW, mine warfare, ship self-defense, and fire-support of troops ashore will be stressed.

Question. Does your FY 1994 request adequately provide the needed and necessary funds to enable you to accomplish your objectives?

Answer. Yes.

Question. In your statement, you discussed the fact that the theater ballistic missile threat is present and growing, particularly in the context of regional conflicts.

I understand the Navy has been active in moving forward with a program to upgrade the capabilities of ships operating in regional theaters, and specifically, enhancing their on-board defensive abilities. (Cooperative Engagement)

Would you discuss this initiative in greater detail for the Committee and indicate how your FY 1994 budget addresses this item.

Answer. Navy and independent studies have concluded that in the future ballistic missiles could become a threat to coastal airfields, debarkation ports, amphibious objective areas and expeditionary forces ashore. In several scenarios, initial defenses must be provided from ships at sea. As a separate effort driven specifically by the cruise missile, the Navy has initiated the Cooperative Engagement program. Basically this program transfers real time sensor data between cooperating units at such a rate that individual ships can develop fire control orders based on off-broad sensor detection data. This capability enables the current AAW system to be more effective against cruise missiles. The theater ballistic missile defense approach being pursued by the Navy is to evolve our current AAW system into ballistic missile defense system and at the same time preserve our current AAW performance. By this approach the Navy can capitalize on a $40B plus investment in the Aegis ship/weapon program. Modification to our current Aegis weapon system is the approach that has been taken.

Detection and tracking software for the SPY–1 radar needs to be modified along with some improvement to the SM–2/Blk IV missile in order to have an endo-atmospheric (lower tier) ballistic missile defense system. The SM–2/Blk IV requires a modified ordnance package (warhead and target detection device) coupled with a multi-mode (RF & IR) guidance capability in order to be an effective ballistic missile interceptor. For a sea based system with greater range capability and effective against exo-atmospheric ballistic missile the Aegis weapon system will require additional changes. An interceptor for the exo-atmospheric (upper tier) application will be a major modification to the current SM–2/Blk IV or a third variant. A cost and operational analysis study has been initiated that will support the selection of the upper tier interceptor. SDI funding support for these programs are reflected in the FY 1994 budget. This effort is budgeted at $240M.

THEATER MISSILE DEFENSE

Question. Follow-up: To what extent have you considered the use of lasers in your defensive capability enhancements for ships, as well as the identification, tracking and destruction of enemy targets?

Answer. While shipboard use of lasers in a defensive role is not a current Navy program, its application has significant cost benefit potential and is under review. To this end, a series of cooperative US/UK/SDIO point defense tests to demonstrate the effectiveness of a high energy laser system against closing anti-ship cruise missiles are planned for FY 1993 and FY 1994 at the White Sands, New Mexico Test Facility. The results of these tests are considered crucial in determining the future of directed energy in the Navy.

[Clerk's note.—End of questions submitted by Mr. Skeen. Questions submitted for the Record and the answers thereto follow:]

REQUIREMENTS FOR WEAPON SYSTEMS

Question. Last year, the Navy eliminated a number of Pentagon "3 star" admiral positions. Gone are separate "3 star" positions for air programs, surface ship programs, submarine programs, and testing programs. The one remaining "3 star" is now responsible for all warfighting requirements. The first person to fill that slot, Vice Admiral Owens, is with us today making his first Congressional appearance in that capacity. What are the Navy's highest priority RDT&E programs?

Answer. The Navy is putting a new emphasis on research and development on precision systems for standoff and direct attack.

These systems are smart, survivable, and offer an affordable alternative when the potential loss of an aircraft or crew poses an unacceptable cost. Specific weapon and senior programs include: Block IV TOMAHAWK cruise missiles which provide non-jammable precision targeting and increased routing flexibility; SLAM missile RDT&E; Joint Standoff Weapon (JSOW) efforts with the USAF; P-3, E-2C, and EP-3 aircraft surveillance upgrades; Joint service efforts in Unmanned Aerial Vehicles (UAVs); Global Positioning System (GPS) upgrades; Communications, intelligence, and mission planning systems that allow coordinated stand-off strikes from submarines, surface ships, and manned-aircraft; and Joint Direct Attack Munitions (JDAM) R&D efforts with the USAF.

Fire support of Marine forces ashore is also high priority. The Navy is currently evaluating the Army's Tactical Missile System (ATACMS) for use from Naval ships in support of amphibious landings. We are also investing in Naval gunfire improvements, including support of DNA work on electro-thermal-chemical artillery cartridges.

Events in the Persian Gulf also demonstrated the need for improvements in mine countermeasures. The Navy has a number of R&D programs to develop critical capabilities for surveillance, detection, and avoidance, and clearance of mines.

The Navy also remains committed to an affordable new design SSN and to enhanced shallow water ASW capabilities.

The Navy continues to focus on Ship Self-Defense. Cooperative Engagement Capability and AEGIS combat systems development provide significant improvements in battle force combat capabilities.

Tactical aviation continues to be a priority. The F/A-18 E/F is a critical, affordable aircraft for the future which brings significant added capabilities. The Navy has also worked closely with the Air Force to develop a joint operational requirement for the A/F-X. Research and development to upgrade a limited number of F-14s to make them multi-mission aircraft is another priority.

Finally, we continue to support a strong Science & Technology investment for long-term future capabilities.

Question. What is the Navy doing differently now in R&D in light of lessons learned from Operation DESERT STORM?

Answer. R&D programs that support jointness, particularly in the area of communications and sensors, are receiving increased emphasis. We are continuing R&D and procurement in support of real-time joint communications, imagery intelligence and mission planning on carrier and amphibious battle group command ships. Further, the Navy has established joint service coordination/oversight of Combat Identification (CID) efforts. A MOA with the Army, Air Force and Marine Corps was signed by the VCNO in January 1993.

Events in the Persian Gulf also established the need for investment in mine countermeasure capability in order to operate in littoral areas and to put forces ashore at minimum risk. The Navy also is putting a new emphasis on research and development on precision systems for standoff and direct attack.

Question. Please describe the plan for submarine programs.

Answer. The Navy is conducting R&D for two submarine construction programs, the SEAWOLF and the New Attack Submarine. Component testing and qualification, as well as combat system development needs to continue for the SEAWOLF to support completion of the SSN–21 and SSN–22 now under construction. The New Attack Submarine effort is in its early stages. A Cost and Operational Effectiveness Analysis (COEA) is evaluating a wide range of alternatives that could satisfy the validated requirement for an attack submarine. Milestone I for the New Attack Submarine should occur late in FY 1993, allowing for selection of an option for further development. Initial procurement of this submarine would come as early as 1998. The FY 1994 budget request contains funds for HM&E and Combat System development, preliminary design, and propulsion plant work.

The Department of Defense is also conducting a review of the requirements and industrial base for submarines. This review continues efforts that began last year. Results are anticipated shortly, and could include measures to preserve the submarine base prior to the start of New Attack Submarine Development.

Submarine combat and weapons systems procurement in FY 1994 will focus on completing near term developments that will deliver combat systems and weapons to the fleet that will provide state-of-the-art capabilities.

The AN/BSY–2 Submarine Combat System will complete the majority of its Full Scale Development effort in FY 1994 to support the first production system being delivered to the shipbuilder in early FY 1995. All three of the production systems, which were contracted for prior to the truncation of the SEAWOLF program, will be procured to fulfill the requirements of SSN–21, SSN–22, and a Consolidated Shore Facility for system support. AN/BSY–2 remains on track to support the SEAWOLF program.

Development of Combat Control System (CCS) MK 2 and the AN/BQQ–5E sonar system (together known as the "QE2") continues with initial unit installation currently in progress. This system, which will replace obsolete equipment and provide substantial improvement in the tactical capabilities of both 688 and 688I SSNs, will complete development in FY 1994 and commence Technical Evaluation. The Development of the TB–29 Thin Line Towed Array parallels the QE2 efforts and will also complete development and begin Technical Evaluation in FY 1994. The TB–29 will provide dramatic improvement in towed array low frequency and broad band performance as well as providing significantly improved tactical capabilities. The TB–29 will be used in the SSN–21 class as well as all QE2 equipped SSN 688/688Is.

The MK 48 ADCAP torpedo program is developing modification kits for backfit into the existing ADCAP inventory. These modifications will provide for quieting of the Torpedo Propulsion Unit (TPU), and upgrade of the torpedo Guidance & Control (G&C) unit to provide for state-of-the-art computing capabilities that will allow for the incorporation of significant shallow water weapon improvements.

Finally, development of new Submarine Defensive Warfare Systems is continuing to provide acoustic countermeasures against both active sonar and acoustic torpedoes.

Question. The Committee has been very concerned about ship self-defense programs for attacks by low observable anti-ship cruise missiles. Please describe the Navy's plan.

Answer. One of today's most stressing threats to Navy ships is from the subsonic sea skimmer missile with low radar cross section (low observable), particularly when employed to effect a close to simultaneous arrival rate. High speed, multi-mode homing missiles which incorporate high G terminal maneuvers are also combat system drivers.

Navy's plan to counter these threats is to consolidate program and fiscal management, focus engineering and development at the ship system level, and coordinate the element acquisition programs that provide for ship defense.

Consolidate management: OPNAV and ASN organizations modified, PEO for Ship Defense established. Single resource sponsor designated.

Ship Defense System Engineering: Interactive review and program planning process established.

Ship Defense plan has three major thrusts: Improve near term ship defense capability by procuring and installing those elements and element upgrades already developed.

Maximize the total ship defense capability of the shipboard defense elements with multisensor integration (MSI) and hardkill/softkill integration.

Develop advance capabilities needed to pace the threat by incorporating proven technologies in systems developments.

Navy is now structured to develop, engineer, integrate, produce and introduce to the fleet total ship AAW defense systems capable of meeting the evolving threat.

An updated Ship Anti-Air Warfare (AAW) Defense Report was submitted to the Congressional Defense Committees on 1 March, 1993 by the Acting Secretary of the Navy. The Ship Anti-Air Warfare Defense Report will be updated on an annual basis.

SHIP SELF DEFENSE

Question. Admiral Owens, since 37 sailors died in the Iraqi cruise missile attack on the U.S.S. Stark, what improvements has the Navy fielded to its ships to improve their self defense capabilities, and in what numbers?

Answer. The specific Self Defense plan is detailed in our report to Congress dated 01 March 1993. Highlights:

FFG–7 Improvements:
  MK 92 Mod 6 Fire Control System (CORT/IADT): 3
  Phalanx Upgrades (Above horizon search, increase magazine capacity): 8
  Outlaw Bandit ———
  AN/SLQ-32(V)5 (Sidekick Active ECM): 2
DD–963 Improvements:
  AN/SPS–40E (Solid State Transmitter): 10
  Target Acquisition System MK 23 (L band AntiShip Cruise Missile detection radar): 24
  Sea Sparrow Missile improvements (ASCM Upgrades): 31
  Outlaw Bandit: 10

  AN/SLQ-32(V)3 (Active ECM): 11
  Phalanx Upgrades: 9
LSD-41 Improvements:
  AN/SPS-49(V)5 (Automatic Target Detection): 4
  Phalanx Upgrades: 3
LHA-1 Improvements:
  AN/SPS-40E (Solid State Transmitter): 4
  AN/SLQ-32(V)3 (Active ECM): 5
  MK 23 TAS: 2
  Rolling Airframe Missile (RAM): 1
  Phalanx Upgrades: 1
LHD-1 Improvements:
  AN/SPS-48E: 2
  AN/SPS-49(V)5 (Automotive Target Detection): 3
  MK 23 TAS: 3
  AN/SLQ-32(V)3 (Active ECM): 3
  NATO Sea Sparrow improvements: 3

NOTE. Number after colon indicates actual installations on ship class.

Additional near term improvements include:

SM-1 Blk VIB-Low altitude missile capability for FFGs
Search/Fire Control Radar Upgrades
(SPS-49 MPU, SPQ-9I, MK 92 Mod 2 "CANDO")

We are expending approximately one-half billion dollars a year on ship self-defense improvements.

Question. Please describe the Navy's strategy and R&D programs for dealing with this problem. (Threat described above.)

Answer. Navy is pursuing a wide range of upgrades and modifications across the entire Detect-Control Engage spectrum to defeat both the current and emerging threat.

A focus of the ship self defense effort is the development of a fully automatic, integrated combat system which is based on fully coordinated detect/control and softkill/hardkill engagement functions.

In the near-term, shipboard self defense systems will install and integrate selected systems to enhance shipboard reaction time. System upgrades include:

CIWS Block 1 Baselines 0/1/2: Increase magazine and rate of fire.

CIWS Block 1 Baseline 3: Sensor upgrade and Higher Order Language computer

Rolling Airframe Missile (RAM): Short range self defense missile will be put on all amphibs and some combatants.

Radar improvements: SPS-49 MPU upgrade (Area search) and SPQ-9 (Fire control) improvements in target detection.

Electronic Warfare improvements: Upgrades to SLQ-32, Outlaw Bandit Program, and decoys.

Maximize the total ship defense with multisensor integration and hardkill/softkill integration. Examples include:

SSDS MK 0 (RAIDS): A tactical decision aid for TAO/CO

SSDS MK 1: Integrates sensors, automates local C&C, directs weapons on fiberoptic Local Area Networks. Demo in LSD–41 on 08 June 93.

SSDS MK 2: Evolutionary expansion of SSDS MK 1 to ships with NATO Sea Sparrow system.

Advanced capabilities will be needed to pace the threat. R&D efforts are being pursued to incorporate future science and technology developments into systems developments. Programs include:

Cooperative Engagement Capability
IRST technologies for both sensors and weapons
Advanced Integrated Electronic Warfare System (AIEWS)
Evolved Sea Sparrow Missile (ESSM).

Current technology efforts in sensors include affordable phased array radar for low RCS signature targets, target identification, and advanced IR sensor development. Technology efforts in engagements include low altitude fusing, high energy density warheads, and potentially High Energy Laser (HEL). Efforts in EW include precision ESM, advanced decoys, and active IR and microwave devices to defeat missile seekers.

Question. Dr. Whitman, describe what actions the Navy has taken to improve the management of Navy ship self-defense programs.

Answer. Created single PEO (Ship Defense) (SD), September 1992

Responsible for acquisition/management of non-AEGIS ship AAW defense programs.

PEO (SD) consists of two principal programs: (1) Cooperative Engagement (CE) and (2) Ship Self Defense (SSD).

CE and SSD each have dedicated program managers (PM)s reporting to PEO (SD).

SSD PM is accountable for all engineering and acquisition management of existing/planned SSD elements (sensors, weapons, command/decision systems).

OPNAV reorganization consolidated requirements sponsorship for SSD under N865.

Fiscal Management Enhancement.

Plans/budgets for all SSD elements are under control of single budget office reporting to PM (SSD).

Beginning in FY94, program elements for ship defense consolidated and restructured for increased accountability.

OPNAV resource sponsorship for SSD consolidated under N86.

Question. Without an upgrade to the capabilities of the E–2 aircraft, the Navy will spend billions of dollars on both cooperative engagement and anti-ballistic missile defense, yet have no long range "eyes" for these expensive systems. What is the Navy's plan to achieve full cooperative engagement capability in the E–2C, and by when? Is this effort fully funded?

Answer. The Navy through NAVAIR has an engineering assessment contract with Grumman Aircraft to conduct a CEC/E–2C study. Results of this study will enable the Navy to develop an engineering program that will result in an integrated CE system in the E–2C. Intent is to install the appropriate equipments that will enable the E–2C to be a totally CEC cooperating unit. The contractor report will be available in the August 1993 time period. The Navy plans and is committed to a fully funded air cooperating unit program that will be fielded in the 1999 time period. The air cooperating unit fielding date assumes that planned miniaturization of CEC equipment can be achieved to the degree that will be specified in the current on going E–2C engineering assessment contract.

NEW ATTACK SUBMARINE: CENTURION

Question. With the demise of SSN–21, the Navy is more aggressively pursuing the new Centurion nuclear attack submarine, whose affordability the Navy says is critical. The fiscal year 1994 budget requests $394 million for Centurion. Explain the pros and cons of simply halting all production and R&D, and restarting a new line later. Is this a viable option?

Answer. This question has been reviewed extensively during the last year, and is still being considered within the Department of Defense. The Navy input to the ongoing Department of Defense review argued strongly that there is not just a need to move forward with the New Attack Submarine development and construction to preserve the industrial base, but that actions will be required between now and 1998 to retain key vendors and the submarine shipbuilders.

While halting the line and starting up again later may result in immediate savings, it is not a prudent option. The two submarine builders are supported by literally hundreds of key vendors for propulsion, electrical, combat system, and other components. Many of these vendors are dependent on Navy work for their survival. A lengthy hiatus in submarine orders will force these vendors to close, or convert to other product lines. Expertise developed over four decades of nuclear submarine construction will be lost with each vendor exiting the submarine business. Some amount of this restructuring is clearly going to occur, even with continual low rate production. If the entire base is allowed to shut down, however, there will be a substantial cost in time, management, and funding to restore the entire base, if it can be done at all.

Halting R&D and construction would abdicate the acknowledged U.S. position of world leader in submarine technology, and require an eventual high risk restart of the base to maintain force levels after the turn of the century. It is far more prudent to proceed with development and construction of the New Attack Submarine, and take necessary measures between now and 1998 to preserve our production and design capability.

Question. What is the Navy requirement for CENTURION in terms of its mission, size, and capability and how does this compare with SEAWOLF?

Answer. CENTURION will be the backbone of the submarine fleet that will serve the U.S. well into the 21st century. It must therefore have the weight and space that will allow it to be flexible enough to accommodate the advances in technology over the next 40 to 50 years.

Regarding stealth, it is believed that SEAWOLF level quieting will maintain the risk to the platform at an acceptable level. This assumption will be further examined by the ongoing CENTURION COEA. Should CENTURION incorporate only SEAWOLF level quieting, it would be the first U.S. submarine design which does not strive to advance quieting to lower levels than the preceding class.

The primary consideration for CENTURION is that it be affordable. To this end, the Navy is exploring acquisition cost reduction initiatives across a wide spectrum, but particularly in the areas of combat systems, stealth, propulsion, and payload, the primary cost drivers in submarine design. Simplification is being stressed wherever practicable by employing Computer Aided Design (CAD) techniques. Automation for controls is being considered in order to minimize crew size. Every effort is also being made to reduce the life cycle costs for the submarine, to include incorporating a more efficient reactor core which will not require replacement over the ship's life.

Question. Describe the alternatives considered but rejected by the Navy based on Trident, SSN–688, and SSN–21 variants.

Answer. The Cost and Operational Effectiveness Analysis for the New Attack Submarine is looking at a full range of alternatives, including those listed in the question above. These include the SSN–21, reduced cost variants of the SSN–21, the SSN–688I incorporating available technology, several new design nuclear submarines, Trident variants with and without missile tube volume, and a conventional submarine. The performance and cost of these alternatives will be evaluated to allow an informed Milestone I decision on which options should be pursued. This decision is anticipated late in FY 1993.

Question. How will the fiscal year 1994 funds be used?

Answer. The FY 1994 funds will be used to support multiple efforts required for design and development of the New Attack Submarine and its systems. A listing of program elements and general work description follows:

Preliminary Design: $52.7M in PE 0603564N funds preliminary design of the alternative selected at Milestone I.

HM&E System Developments: $104M in PE 0604558N and $35M of "CENTURION unique" efforts in PE 0603561N continue advanced developments and initiate system developments to support the first systems needed in the yard for the FY 1998 lead ship (Main Propulsion Unit and Propulsor), as well as cost reduction and producibility efforts for HM&E systems.

Combat Systems Developments: $136M in PE 0604558N funds development of all 15 non-propulsion electronic systems that comprise the combat systems suite. FY 1994 activities include selection from existing systems of a hardware baseline for the combat system suite to allow incorporation of Commercial Off the Shelf (COTS) equipment, thereby reducing acquisition and life cycle costs, and evaluation of packaging initiatives to reduce space and weight.

S9G Nuclear Propulsion Plant: $66M in PE 0603570N funds preliminary design of advanced nuclear components and systems, including plant arrangements, heat and fluid transfer systems, and electronic/electrical equipment, emphasizing simplification while taking advantage of existing and new technologies.

Question. How exactly do you plan to make Centurion more affordable than SEAWOLF?

Answer. Several approaches will be used to make Centurion more affordable. The Cost and Operational Effectiveness Analysis (COEA) may identify areas where we do not need the capabilities in SEAWOLF, allowing some savings. System design will be simplified where possible. We will take advantage of automated design and producibility inputs from vendors. Among the areas being examined to achieve savings are reduced numbers of pipe hangers and machinery resilient elements, fewer air conditioning plants, hydraulic pumps, and trim and drain pumps, full industrialized application of target strength hull coatings, and new technologies in pump impellers, low pressure pipe systems, and hydraulic actuators, and use of an existing combat system as a hardware baseline to allow incorporation of Commercial Off the Shelf (COTS) equipment.

Question. What are your cost goals for Centurion compared to SEAWOLF: total development, production, and unit costs?

Answer. No cost goals for Centurion have been formally established. Clearly, we want something less expensive than SEAWOLF, or we won't buy in sufficient numbers to maintain force levels. Cost estimates for the alternatives in the Cost and Operational Effectiveness Analysis are being developed to support the Milestone I decision late in FY 1993. The order of magnitude R&D cost for the entire program is from $3.4B to $4.4B.

Question. In what year do you anticipate Centurion IOC?

Answer. Assuming a FY 1998 authorization, IOC should occur in 2004 or 2005.

Question. While many of the metal components of submarines are made by single vendors, most of the electronics do not need to be. Does the Navy plan to sole source the development of the Centurion combat system? Explain how the Navy will achieve an "open" computer systems architecture for the Centurion.

Answer. The New Attack Submarine is currently in Phase O (Concept Definition) of the acquisition process. The acquisition strategy for procurement as well as the Phase I detailed design strategy is being developed and will be approved in conjunction with the Milestone I decision. The use of Commercial Off the Shelf (COTS) and Non-Development Items (NDI) will be fully investigated in Phase I to determine the optimum use to realize system procurement cost reduction while minimizing the RDT&E required to achieve the transition from MILSPEC components. To optimize the benefits of incorporating COTS equipment, a transition to an Open System Architecture is being investigated. A three year, three phase concept study has been initiated. Industry participation has been achieved through a Broad Agency Announcement (BAA).

A/F–X AIRCRAFT

Question. The fiscal year 1994 budget requests about $399 million to continue the A/F–X development program. In 1994, the Navy plans to select 2 of the 4 existing contractor teams to move into the next phase of the program called "demonstration/validation" which will cost $5.3 billion. A–X replaced A–12 which would have replaced A–6 aircraft. A–6 and A–12 aircraft are both subsonic and their radars have no long range air-to-air capability. Last year, the

Navy changed the name of this program from "A-X to A/F-X". Dr. Whitman, please explain this important distinction and its rationale.

Answer. The MNS, TOR and ORD reflect the need for a multimission aircraft. Further, the need for multimission aircraft was a direct lesson learned from DESERT STORM. The change in name was done to emphasize the multimission aspect of AFX. No requirements were changed when the name was changed. For the Navy the desire is for all aircraft to be multimission to provide the maximum flexibility for the carrier air wing.

Question. Please explain what air-to-air missions are now envisioned for A/F-X and how this compares to what was planned for A-12.

Answer. The air-to-air mission for AFX are those required for self defense or to augment other fighter aircraft in the carrier air wing. The primary mission of the aircraft, however, is long range strike. The A-12 had a limited air-to-air capability that was to be expanded on during a P3I phase. The baseline A-12 was to employ AMRAAM. AFX is to fully employ AMRAAM, AMRAAM P3I and AIM-9X. During A-12, the Navy had an advanced fighter program in the NATF.

Question. Based on what you have seen from contractor proposals, compare A/F-X aircraft to F-22 (ATF), F-14 and F-18 in terms of size, speed, range, etc.

Answer. The AFX will be in the same class in size as the F-14. The AFX ORD requires a spotting factor of 1.42 or less. The F-14 has a spotting factor of 1.32, the F/A-18/E/F=1.25, and F/A-18C=1.0. There is no spotting factor for the F-22, but it is bigger than the AFX, F-14 and F/A-18E/F.

Question. How does the A/F-X total development cost compare to the F-22 cost, when converted to equivalent constant dollars?

Answer. According to the data in the recently submitted "Report to Congress on Fixed Wing Tactical Aviation Modernization" the AFX and F-22 development costs are comparable in constant dollars ($19.2B for F-22 and $19.5B for AFX in FY-94 $). It is further noted that the current AFX program office projection for AFX development is $19.3B FY 1994 $.

Question. How much more does it cost to carry 2 contractor teams rather than 1 into the "DEM/VAL" phase of the program?

Answer. The added cost in DEM/VAL for carrying a second contractor is approximately $2B. This includes an additional cost for the stretch out of the development to account for the one year required for down-select between DEM/VAL and E&MD.

Question. How much could be eliminated from the 1994 budget if Congress no longer required such a strategy?

Answer. Approximately $175M could be reduced from the FY-94 requirement if the decision is made to go with a single team in DEM/VAL.

Question. How would you characterize the pace of this program?

Answer. The notional program plan has been laid out to adequately manage the risks associated with a program of this scope. It is a balanced approach with limited concurrency. The DSB stated that "the planned DEM/VAL program appears to be structured to accommodate a substantial risk reduction effort."

Question. A recent press article quoted a Navy Admiral in aviation programs who thought that one-third of the $22.8 billion development cost of this program could be saved by looking into a single seat/single engine version of the aircraft. What is the Navy doing to examine this option?

Answer. The Navy has looked into both single seat and single engine options. The conclusion on engines was that the savings for a single engine design were not enough to offset the higher attrition rates over a twin engine design. The issues of one vs two seats will be studied more fully during DEM/VAL. At this time a two seat requirement will be maintained; at a minimum, a requirement for a two-seat trainer during E&MD would be required even if the baseline requirements changed.

Question. How would the Air Force use the A/F–X, and is this considered to be a joint program? What funds has the Air Force contributed?

Answer. The AFX is planned to replace the F–15E, F–111, and F–117 for the Air Force. The AFX Joint ORD was developed by a joint team of Air Force and Navy personnel and has been signed by both Service Chiefs. The key ORD parameters have been validated by the JROC. This program will be designated a joint program at milestone I. Air Force contributions to the AFX program have been in the area of extensive stealth research and development, and F–22 aircraft developmental items like avionics, engines, etc. The Air Force funding has been restricted to Program Management support. It should be further stressed that Air Force personnel are completely integrated in our Program Office, providing valuable contributions to this vital program.

Question. Describe the F–22 technologies which are planned to be used in A/F–X. For the record, name each major F–22 component that will be used without change, and those which will be adapted indicating the extent of change necessary.

Answer. Key avionics, propulsion, materials and stealth technologies will be used on the AFX. The exact extent will vary depending on the contractor design(s) selected. The Navy and Air Force have been sharing technical data to ensure full transfer into the AFX program. Detailed components from the F–22 cannot be identified at this time prior to source selection.

F–14 AIRCRAFT

The Navy's 1994 budget includes $72 million to begin development of new upgrades to the F–14, mainly to provide air to ground capability.

Question. Do you plan to manufacture new aircraft?

Answer. The Navy does not plan to manufacture new F–14 aircraft.

Question. The Air Force included radar upgrades in its F–15E ground attack aircraft which were used in Iraq. Why is the Navy not pursuing radar upgrades for the F–14?

Answer. In the Block 1 program, the F–15E ground attack radar improvements will be added to the F–14D. Due to the great similarity in technology of the F–15E (APG–70) and F–14D (APG–71) radar, these changes will be software only. These improvements can not be added to the F–14A or F–14B (AWG–9 radar) without significant radar system hardware, as well as software modifications.

Question. What ordnance will be carried by a "Block 1" F–14, and with what accuracy compared to other Navy aircraft (e.g. A-6)?

Answer. The Block 1 Strike Upgrade will retain the ability to carry and deliver the Mk–80 series bombs but will add the additional capability to carry and self-designate for the delivery of precision laser-guided class of weapons. The delivery accuracy will be in the six to seven milliradian range for the Mk–80 series ballistic bombs, and for laser-guided bombs (LGBs), will be the same as any other LGB capable aircraft.

Question. What is the Navy's strategy for avionics upgrades to F-14? Does the Navy have a "notional" Block 2 in mind?

Answer. The F–14A/B Survivability/Structural Upgrade program will modify a core of F–14 A and B aircraft with the following avionics upgrades: digital ALR–67 Radar Warning Receiver, two digital programmable displays, improvements to the 5400B mission computer, a digital AWG–15G weapons control system, and two MIL–STD–1553B digital data buses for information transfer. As part of Block 1 Strike Upgrade program, all upgraded F–14 A and B aircraft will also receive the improved F–14D Heads-Up Display (HUD), an integrated Inertial Navigation System and Global Positioning System, Night Vision Cockpit, the ability to carry a Forward Looking Infrared (FLIR) pod, as well as the ALE–50 Defensive Electronics Countermeasures system. The Navy has not identified requirements for upgrades beyond the Block 1.

Question. Provide for the record a detailed breakout of how the $25 million appropriated by Congress only for F–14 Quickstrike was used.

Currently, $25 million in FY–1993 funding is on OSD Comptroller withhold, which upon release will be used in FY–1994 on the Pre-Deployment Update effort.

NEW MODEL F/A–18E/F AIRCRAFT

Question. The 1994 budget requests about $1.4 billion in R&D funds to continue development of the new model F/A–18E/F. Dr. Whitman, what is the status of the F/A–18E/F development program?

Answer. The program is on cost and on schedule. An Integrated Management Information Control System (IMICS) has been implemented which allows the program office to monitor the contractor's schedule and cost process. In addition, the program office, McDonnell Douglas, Northrop, and General Electric have established Program Independent Analysis (PIA) teams which conduct impartial independent assessments and report directly to program management. As a result, communications are improved and potential problems are surfaced early enough to take corrective action and mitigate risk. The F/A–18E/F program has successfully completed an Engine Preliminary Design Review in October 1992 and an Airframe Initial Design Review in September of 1992. In addition, the Engineering and Manufacturing Development (E&MD) airframe and engine contracts were awarded in July 1992 and definitized in

December 1992. First Engine To Test is currently projected for 19 May 1993.

Question. Please describe the performance demonstrated to date under the F/A–18E/F program contracts in terms of weight and range?

Answer. The program is still in the design phase with critical design review planned for FY 1994. First flight of the F/A–18E/F is planned for FY 1996. Accordingly no aircraft level performance has yet been demonstrated. However, current performance projections, based on design analyses and wind tunnel testing of scale models, indicate that the F/A–18E/F will meet weight specification and will meet or exceed range specifications.

Question. When are first flight and IOC scheduled, and have these changed materially since last year?

Answer. First flight is scheduled for December 1995 and IOC is scheduled for the year 2000. The IOC date has not changed from that projected last year. The first flight date, however, has slipped two months compared to last year's projections as a result of program adjustments necessitated by the $190M funding reduction in FY 1993.

Question. Admiral Owens, some criticisms of F–18E/F include:

An increase of only 100–150 miles in range does not justify a $6 billion investment.

The upgrade only adds about 2½ years of service life to the aircraft.

There are minimal avionics upgrades. The inevitable avionics "pre-planned product improvement" someday in the future will cost a fortune.

How do you rebut these arguments?

Answer. Taking the issues you raise one at a time:

"An increase of only 100–150 miles in range does not justify a $6 billion investment".

The F/A–18E/F upgrade is designed to solve F/A–18C/D shortfalls in a number of areas:

Increased mission radius (additional 3600 pounds of internal fuel and compatibility with 480 gallon fuel tanks).

Increased carrier recovery payload (9000 pounds bring-back).

Improved survivability/reduced vulnerability

Payload flexibility (two additional ordnance stations)

Compatibility with aerial refueling store; i.e., ability to provide fuel to other aircraft during aerial refueling.

System growth margin (F/A–18C/D has no volume, electrical power or cooling capacity remaining).

"The upgrade only adds about 2½ years of service life to the aircraft."

Structural life is essentially the same as F/A–18C/D; approximately 20 years and comparable to other tactical aircraft.

17+ years of growth capability available with F/A–18E/F where essentially none exists with the F/A–18C/D.

This growth capability gives the F/A–18E/F the ability to incorporate additional capability in response to future threats.

> "There are minimal avionics upgrades. The inevitable avionics 'pre-planned product improvement' someday in the future will cost a fortune."
>
> Current avionics baseline satisfies threat requirements.
>
> Continued evolutionary growth plan will avoid an avionics bowwave.
>
> The future threat will define the requirement, i.e., we will put in what we need when we need it.

Question. How many older model F–18s (the Navy's newest aircraft) will be retired in the next few years and placed into storage? For the record, provide a breakdown by fiscal year and model/series.

Answer. There will be 41 aircraft retired through FY98. These aircraft are earlier Lots (IV and below) that have a 3000 hour fatigue life. There is no plan to place any of these aircraft in storage. Usable parts will be removed and the aircraft salvaged. The breakdown by fiscal year of F/A–18A/B aircraft to be retired are:

FY93	8
FY94	7
FY95	7
FY96	12
FY97	5
FY98	2

Question. Is there a problem with the F–414 engine which will have to be inspected twice as often as planned?

Answer. The analysis of the current F–414 design indicates that under a very conservative method of predicting life, the first stage fan disk would require more inspections than originally anticipated. However, there are several design options under consideration which the engine manufacturer, General Electric, believes will eliminate any need for increased inspections. These approaches include: (1) Design refinement of the location of the disk which is driving the higher inspections. These refinements include material surface enhancements which have yielded life improvements in the past. (2) Adopting a slightly less conservative life prediction methodology, but one that is still more conservative than used on any current Navy engine. This approach already indicates the disk will fully meet the originally planned inspection requirements. (3) Utilizing a different disk material which will also improve the inspection interval but may have other drawbacks such as increased weight. One or a combination of the above options is believed to achieve the desired inspection interval for the Fan Disk. No other parts are projected to require increased inspection rates.

V–22 DEVELOPMENT PROGRAM

Question. The Navy's budget contains $82 million to continue the V–22 development program. The Navy has signed letter contracts for the $1.5 billion previously appropriated for V–22 R&D and is currently negotiating the details with the contractors.

Dr. WHITMAN. When will the V–22 contracts be definitized (i.e., final)?

Answer. A letter contract for airframe Engineering, Manufacture and Development (EMD) was awarded October 22, 1992. We expect to definitize the contract by February, 1994. A letter contract for the EMD engine program was awarded December 29, 1992. We expect to definitize this contract by July, 1993.

Question. The Committee understands that the airframe contract will only modify 2 existing aircraft and build 4 new ones. Is it true that the Navy is not including production options in the V–22 R&D contracts?

Answer. The EMD contracts do not include production options. The Navy did not request production options nor did Bell-Boeing propose any.

Question. Do you believe that the government could save a substantial amount of money if the V–22 R&D contracts contained production options, since subcontractors and other vendors would realize lower investment costs if they were assured of a chance for production?

Answer. No, the development contracts are cost-plus type contracts. There is no reason to believe that inclusion of production options would significantly reduce the cost of the effort to be completed under the development contracts.

Question. Has the Defense Department included any funds in the 1994 budget or the outyears for V–22 production?

Answer. We expect to address V–22 production in the FY 1995 budget preparation.

Question. Last year the Commandant wrote to the Committee and strongly reiterated his desire to achieve a 1998 IOC for V–22, as stated in the DOD requirements document which governs this contract. After these contracts are definitized, is a 1998 IOC still achievable?

Answer. No, the present EMD Program will support, at the earliest, a FY 1999 IOC (a 12 aircraft training squadron) if production is initiated in FY 1996.

Question. Can IOC be achieved without production funds?

Answer. No, the EMD program is only funded to modify 2 existing aircraft and build 4 new ones. Additional funds are required to procure the twelve aircraft needed to achieve IOC.

Question. So, you would agree that the current $1.5 billion V–22 program will not achieve the Commandant's IOC?

Answer. Yes, additional funding will be required in FY 1995 and outyears to complete the EMD program and fund production of the aircraft needed to achieve IOC. If production is initiated in FY 1996, the earliest IOC will be in FY 1999, a year later than the Commandant's desired IOC.

E–2 AIRCRAFT

Question. The 1994 budget contains $49 million to begin a $180 million development to improve the E–2 aircraft's computer and other avionics. Admiral Owens, what are the deficiencies of the E–2 today?

Answer. The current mission computer, the L304, has reached its growth limit. The saturation of the mission computer was the number one deficiency out of Desert Storm. The current computer prevents the full exploitation of the current system capabilities and its replacement is required for the integration of the Cooperative Engagement system in the aircraft. The E–2C has no SATCOM capability, only limited data fusion capability in the form of Link 11 and Link 16 and it has no tactical cockpit which would increase the number of operators without increasing the crew size.

Question. Dr. Whitman, please explain the Navy's acquisition strategy for the E–2 upgrade program.

Answer. The Navy has a program for the retrofit of 54 E–2C Group 0 and Group I aircraft (18 and 36 respectively) to the Group II configuration (APS–145 radar and T56–A–427 engine). The 18 Group I aircraft will be retrofitted first (FY 1993/4/5) followed by the Group 0 aircraft. The mission computer upgrade is required to handle the processing requirements of the E–2 mission, in particular, cooperative engagement, and will begin development in FY 1994 with full production expected to begin in FY 2000. Additional upgrades to the Group II baseline include incorporation of JTIDS, navigation upgrades, communication upgrades, improved cockpit lighting, enhanced displays, and enhanced high speed processor.

Question. In 1987, the Navy submitted in "urgent" reprogramming for a concept called cooperative engagement, where ships share radar information to protect themselves from cruise missile attack. Ship radars can only see a low flying cruise missile at relatively short distances, due to the curvature of the earth. Cooperative engagement, for which the Navy has spent over $.5 billion to date, therefore will not work effectively without airborne early warning sensors. What plans does the Navy have to develop full cooperative engagement capability for the E–2, and when will it be fielded?

Answer. For planning purposes, the Navy is looking for a FY 1999 Initial Operational Capability (IOC) for CEC in the E–2C. The Navy awarded a study to Grumman in February 1993 to develop a plan to get to the FY 1999 IOC, provide cost estimates for the program, and provide an architectural plan to incorporate the CEC capability into the E–2C. The final report is expected in November 1993.

Question. Why has the Navy been working on cooperative engagement for 7 years, but has not yet formulated a plan to include the mandatory E–2C into the network?

Answer. The Navy has been studying the need for an air component of CEC for a number of years. The Navy plan is for a FY 1999 Initial Operational Capability (IOC) for CEC in the E–2C. To develop a detailed plan for the E–2C, the Navy awarded a study to Grumman in February 1993 to provide cost estimates and provide an architectural plan. The final report is expected in November 1993.

Question. Compare current and total outyear funding streams and estimated IOC dates for E–2C computer upgrades and full cooperative engagement capabilities. Differentiate funded and unfunded plans.

Anwer. All RDT&E funds for the mission computer upgrade have been budgeted through the FYDP. The portion of the total procurement ($105M of $208M) properly allocated to the FYDP years has been budgeted. The CEC Program Office has estimated $350M for the E–2C cooperative engagement program and is within their budget controls. The final cost estimates are pending the results of the Grumman study to be finalized in November 1993.

Question. How much has the Navy spent to date on miniaturization of cooperative engagement technology for airborne applications?

Answer. Approximately $48.5M has been spent on miniaturization of the CEC technology critical for the airborne application. The CEC program provided $30M for this effort with an additional $18.5M being provided through ARPA (Navy MANTECH program) for the transmit/receive modules.

P-3 UPGRADES

Question. The P-3 fleet is getting old, and many will be retired as the force structure shrinks. However, the Navy has a new plan to significantly upgrade the capabilities of 68 P-3C aircraft for locating surface targets for attack which could cost $600 million. Admiral Owens, please describe your strategy for upgrading the P-3 fleet.

Answer. In response to the changing global situation and attendant realignment of Naval strategy, we have begun a P-3 modernization plan focusing on a more tailored force emphasizing regional and littoral conflict. The key elements of the plan address sustaining inventory, reducing multiple configurations and mission system upgrades. The specific programs include: (1) Extension of the current projected operational service life of the P-3C an average 7-8 years through the Sustained Readiness Program (SRP), (2) continued transition of the Naval Reserve force to the P-3C aircraft, (3) conversion of remaining P-3C aircraft to the Update III system, resulting in one common fleet configuration (4) and an initial block modification of approximately one third of the Update III force with enhanced Anti-Surface Warfare (ASUW), Command, Control, Communication (C3) and Joint Surveillance capabilities.

Question. What advantages does a P-3 have in missions other than its traditional submarine hunting mission?

Answer. The unique Multi-Mission capability of the P-3 and its crew lends itself as a highly leveraged force multiplier which enhances the battle group's ability to operate in the complex littoral environment. Its large payload capacity, weapon system integration, and extensive crew training permit simultaneous performance of multiple tasks. The P-3 continues to meet our requirements for a long range patrol aircraft capable of meeting joint surveillance demands, support interdiction operations, provide battle group support, collect intelligence, provide verification for Indications and Warnings (I&W) from national sensors, accurately deliver mines, conduct counter-drug operations and support bilateral political-military objectives. The current Navy modernization plan ensures that the MPA force will remain highly effective in joint littoral and battle group operations while continuing to counter any third world submarine threat.

Question. Dr. Whitman, please describe the acquisition strategy for this initiative. Will this be sole-sourced to Lockheed?

Answer. The acquisition approach for the initiatives discussed by Admiral Owens will be full and open competition, and will not be sole-sourced to Lockheed.

Question. Congress provided funds in fiscal year 1992 for P–3 engine upgrades, using a derivative of the V–22 engine. Why does your new plan not address new engines?

Answer. The Navy's primary interest in a new engine for the P–3 would be for new aircraft procurement, for which the engine integration and qualification would be the long lead item. For affordability reasons, however, our current budget does not include new P–3 aircraft procurement nor the associated engine effort. We plan to revisit this issue during fiscal year 1996 budget preparation.

We have also considered a program of installing new engines on the Navy's existing P–3 aircraft. Such a program, however, does not appear to be cost effective nor affordable at this time.

L–X PROGRAM

Question. The budget includes $23 million to begin ship design on a new amphibious ship. The Committee has been very interested in assuring that Navy ships can defend themselves adequately in a U.S.S. Stark-like cruise missile attack. Amphibious ships are lucrative targets since they carry large numbers of troops, equipment, supplies, aircraft, and LCACs. General Krulak, how were amphibious ships used in Operation DESERT STORM?

Answer. At the beginning of DESERT STORM, the Naval Component Commander had thirty-one amphibious ships under his control. Additionally, five Military Sealift Command ships were part of the amphibious forces, carrying the assault follow-on echelon required to support the landing force. The supporting craft included seventeen landing craft, air cushioned (LCAC) and thirteen utility landing craft (LCU).

The amphibious ships were organized in three distinct forces; the 13th MEU(SOC) was embarked on five ships, conducting specialized advance force operations. The 4th MEB, embarked on thirteen ships, and the 5th MEB, embarked on twelve ships provided the amphibious assault forces. These three Marine Air-Ground Task Forces provided the CinC, General Schwartzkopf, a flexible, rapidly employable striking force, operating from the sea, able to project power along the Saudi and Kuwaiti coast as he directed. One ship, the USS Tripoli, was configured to carry airborne mine countermeasures (AMCM) units into the Northern Gulf to assist in mine clearing operations.

Amphibious operations during DESERT STORM included a raid on Maridim Island on 29 January, three amphibious feints towards Ash Shuaybah on 25 February and Faylaka and Bubiyan Islands on 26 February. The largest operation was the offload of the 5th MEB in Saudi Arabia on 24 February, providing the Marine Forces Commander in Kuwait an operational reserve.

During the conduct of the air campaign these forces combined to conduct the largest amphibious exercise since the Inchon landings during the Korean War. Highly publicized by the allied news media, this exercise provided a two-fold benefit; it allowed for a dress rehearsal of the Kuwait assault plans under consideration, and fostered anxiety in the Iraqi High Command as to the reality and magnitude of this coalition military capability. Once the ground campaign commenced, the effect of the amphibious raid and the feints caused the Iraqis to blink, delaying the employment of five Iraqi divisions in opposing the advance of Marine forces advancing in Kuwait.

One point to be made is that although the thirty-one ships operating in support of Operation DESERT STORM were a sizable force, it was not enough to load the assault echelons of two Marine expeditionary brigades. This caused the distribution of embarked Marine and Navy forces aboard the available ships to be more concentrated than is considered optimal for combat operations. This configuration limited flexibility and could have severely impacted mission accomplishment in the event one or more of the amphibious task force ships were damaged or lost.

Question. How far from the enemy coast were the ships, and how many troops were on them?

Answer. During the execution of the feints at the outset of the ground campaign, the USS Okinawa and USS Portland operated 50–60 miles off the Kuwaiti coast. The USS Nassau, which conducted air strikes on Faylaka Island and the mainland of Kuwait, operated some 80 miles off the southern coast of Kuwait with five other ships of the amphibious task force. On 26 February, the Nassau moved within 40 miles of the coast to launch the feint toward Faylaka Island.

The remaining amphibious ships transporting the 4th MEB were in an amphibious operating box about fifty miles further south, prepared to conduct an assault if the situation on the ground dictated an amphibious envelopment. Once the brigade was landed in Northern Saudi Arabia, the ships of the 5th MEB operated off the Saudi Coast, ready to re-embark the Marines if they were required to land over the beaches of Kuwait. Lastly, the remaining ships of ARG Alpha-less Okinawa, carrying the bulk of the 13th MEU(SOC), operated with 4th MEB ships until moving North to accept the surrender of the Iraqi garrison on Faylaka Island and transport the resulting prisoners to prisoner of war camps in Saudi Arabia.

The total numbers of embarked Marines and Sailors on amphibious ships during Desert Shield numbered over 17,000 personnel. 4th MEB and 5th MEB each were comprised of 7,500 personnel and the 13th MEU(SOC), 2,300. Of the three ships which operated closest to the coast; Nassau, Okinawa, and Portland, the embarked forces totaled about 3,000 personnel.

The USS Tripoli, which offloaded its Marines to embark an airborne mine countermeasures squadron on 22 January to support mine clearing operations in the Northern Gulf, struck a moored contact mine while operating approximately 50 miles off the Kuwaiti coast on 18 February, 1991. The ship returned to Bahrain for repairs.

Question. What is the self-defense capability of amphibious assault ships today against Exocet missiles?

Answer. The self-defense capability of amphibious assault ships today against Exocet missiles is generally limited to the short range Phalanx CIWS. While CIWS gives proven capability against a single ASCM, it is inadequate for multiple engagements and against the evolving ASCM threat. A significant improvement in self-defense will be achieved with the installation of the Rolling

Airframe Missile (RAM) and the automated Ship Self-Defense System (SSDS) on "L" class ships. USS PELELIU (LHA 5) received the first RAM installation in January 1993. A Ship Self-Defense System (SSDS) Mk 1 demonstration will be conducted onboard USS WHIDBEY ISLAND (LSD 41) in June 1993. Improved firepower with RAM and SSDS will greatly enhance amphibious assault ships self-defense capability.

Question. Admiral Owens, what is the requirement for a new amphibious ship and why is it needed by 1988?

Answer. LX is needed to replace the amphibious lift now carried by four classes of amphibious ships—LKAs, LPD 4s, LSD 36s and LSTs—which will retire between now and 2007. Moreover, block obsolescence occurs for most of these four classes beginning about 2004.

The lead LX is planned for award in FY 1996 with delivery in 2002.

Question. What self-defense capabilities does the Navy plan for LX, and how does this compare/differ from what the Navy plans to provide for its aircraft carriers?

Answer. LX self-defense capability differs from what is planned for aircraft carriers because of its different mission design. However, LX will be built with an SSDS MK 1 to both integrate and automate self-defense sensors and weapons systems and will include two RAM launchers (vice 2 or 3 NATO Sea Sparrow launchers on a carrier) and two CIWS (vice 3 or 4 on a carrier). LX will also receive one SLQ-32(V)3 ECM suite (similar to the SLQ-32(V)4 on a carrier).

Question. Please explain how ship classes can be consolidated once LX is introduced into the fleet?

Answer. In 1990 the Defense Acquisition Board (DAB) approved Milestone 0 for the LX and directed a Cost and Operational Effectiveness Analysis (COEA) to study the best means to replace vessels retiring during the next decade to meet lift goals through Fiscal Year 2010. The LX COEA examined the number and cost of alternative LX ship designs to maintain wartime and peacetime forward presence amphibious lift goals. The operational effectiveness of the alternatives were examined in terms of their suitability for MEB and Amphibious Readiness Group (ARG) operations; support of the ship-to-shore buildup of Marines with landing craft and helicopters; and survivability against enemy threats. The COEA showed that in addressing the future lift shortfall, the Navy should not replace retiring amphibious ships on a one-for-one basis. Rather, we should make up the shortfall by replacing smaller and frequently single-dimension ships with medium sized, multidimensional ships. The new ships must provide both a full service aviation capability for several helicopters and over-the-horizon (OTH) surface assault capability similar to the capabilities currently provided by LPD class ships.

The Navy plans to procure 12 LX-class ships to replace the retiring LKA, LST, and LPD classes. These ships coupled with the 15 ships remaining from the current force and those currently under construction will result in a 35-ship amphibious force in 2008 composed of LHAs, LHDs, LSD41/LSD49s, and LXs. This compact, flexible force will support 11 Amphibious Ready Groups (ARGs) for forward presence and provide 2.5 MEBs lift. An additional LHD, the seventh, would be required to fully support the 12 ARG goal, but is unaffordable under the current fiscally constrained shipbuilding plan. The Defense Acquisition Board reviewed the COEA and shipbuilding plan and gave Milestone I approval for LX program development in January 1993.

Question. Dr. Whitman, what are the Navy's acquisition strategy, development and production cost estimates in then year dollars, and the key milestones for the LX program?

Answer. The Navy's acquisition strategy for the LX is similar to many other major surface ships. The Navy will prepare a contract design specification and bid package. Several U.S. shipbuilders will participate to ensure that the latest in shipyard producibility techniques are considered. A contract will be awarded for Detail Design and Construction to a U.S. shipbuilder selected through full and open competition.

The development cost estimate includes $23.4M of RDT&E funding in FY 1994 with an additional $7.5M required in FY 1995 and FY 1996 to support award of the lead ship in FY 1996. The production cost estimate provided to the Defense Acquisition Board in January 1993 was $847M for the FY 1996 lead ship. The then year estimates for the remaining 11 ships of the class averaged $667M. These estimates are being changed to reflect the revised inflation assumptions of the final FY 94 Presidents Budget and will be further refined during the R&D phase of the program.

Key Milestones for the LX are:

Milestone 0 November 1990 (actual).
Milestone I January 1993 (actual).
Milestone II Fourth Qtr 1995.
Lead Ship Award Second Qtr 1996.
Follow Ship Award Second Qtr 1998.
Milestone III First Qtr 2004.

Question. Identify all LX funding, to include classified if applicable, for LX in 94 and in total by program element.

Answer. The President's Budget request for FY 1994 includes $23.4M in RDT&E funding for LX. This is included as part of Program Element 0604567N. There is additional generic development work in the Ship Self-Defense Program which may develop systems which could be included in the LX program. RDT&E funding required to develop the LX program from FY 1995 through program completion is estimated at $14.7M and this will also be in Program Element 0604567N.

Question. Is this ship to operate in littoral waters? Correlate this ship's mission to "From the Sea." Describe its environment and the force with which it will be operating. Describe a range of scenarios that it will likely operate in and the operational concept to which it will contribute.

Answer. As an amphibious assault ship, LX can be expected to operate in littoral waters. LX will be a component of an "enabling Naval Expeditionary Force . . . shaped for joint operations . . . operating forward, from the sea." This Naval Expeditionary Force will be "tailored for national needs."

The LX will operate as part of an Amphibious Task Force (ATF) during crisis response and as a part of an Amphibious Ready Group (ARG) during routine forward-presence deployments.

LX will contribute to a variety of missions ranging from amphibious assault to any one of the 22 Marine Expeditionary Unit (Special Operations Capable) missions.

Question. Describe the threat the ship will face. Specifically address, in detail, the ship self-defense capability that it will have in a detect, control, and engage context. Relate this context back to the Keuster's study recommendations.

Answer. One of today's most stressing threats to Navy ships is from the sub-sonic sea-skimming missile with a small radar cross-section (low observable), particularly when employed to effect a nearly simultaneous arrival rate. High speed anti-ship missiles which incorporate high G terminal maneuvers are also combat system drivers.

LX self defense includes the following equipment:

Detect: AN/SPS–49(V)5 Air Search Radar, Phalanx Close-In Weapon System (CIWS) Block I Baseline 2 (2), SLQ–32(V)3 EW suite

Control: SSDS MK 1

Engage: Rolling Airframe Missile (RAM)—2; Phalanx Close In Weapon System (CIWS)—2; SLQ–32(V)3 EW Suite; MK 36 Decoy Launching System (DLS)

The development of the LX self-defense suite closely follows the basic AAW recommendations expressed in the Kuester's report. In the detection area, the LX will have an excellent 2D air search radar and the Medium Pulse Repetition Frequency (PRF) Upgrade (MPU) is planned for future installation. Phalanx CIWS sensor improvements are also planned for LX class ships. For integration, the LX will include the SSDS MK 1, a distributed, open architecture self-defense system integrating all onboard sensors and weapons. For engagements, LX will have two RAM missile systems and two CIWS gun systems, both of which closely follow the Kuester report's recommendations for installing RAM on "L" class ships and continuing CIWS improvements.

The planned self-defense system onboard LX will give it an excellent capability versus the near-term ASCM threat and allow it to safely operate in the littoral region.

Question. What will be the ship self-defense effectiveness of the ship versus the low flying cruise missile threat (Exocet and advanced versions). State this effectiveness in qualitative terms.

Answer. With the proposed ship self-defense configuration, LX will have a very effective self-defense capability. The RAM missile brings near-term engagement capability versus the low flying cruise missile threat (Exocet type missiles) and the two launcher installation provides 360 degree coverage. The dual CIWS Block I installation provides an additional inner self defense engagement layer. SLQ–32(V)3 active ECM and the Decoy Launching System provide a significant softkill capability. The SSDS Mk 1 will integrate sensors and weapons, integrate hardkill and softkill, and allow fully automated self-defense responses. With continued improvements to the self-defense systems (SPS–49 MPU, CIWS Block

I Baseline 3, RAM IRMU), LX will be able to defend itself against an advanced ASCM threat.

Question. Describe the command, control, and communications design parameters (including requirements) of the ship. Will it control aircraft: What kind, in what missions? What are the planned surveillance capabilities?

Answer. The LX will have sufficient Command, Control, Communications, Computer and Intelligence (C^4I) capability to embark, transport and land elements of a Landing Force in an assault on a hostile shore by helicopters, landing craft, amphibious vehicles and by a combination of these methods. The LX will be capable of generalized air traffic control of helicopters and fixed-wing aircraft. For helicopter/VTOL aircraft, specific missions will include launch and recovery, ship-to-shore movement, and search and rescue. The LX will have air search, surface search and electronic surveillance capability.

Question. What is the rough "cost bogey" for this ship, and how does this compare to existing similar ship classes in constant dollars? How much is allocated to HM&E, combat system, etc?

Answer. The current cost estimate for the lead ship of the LX class is $847M in FY 1996 dollars. There are no comparable existing ship classes to the LX. The last similar ship procurement was the LPD 4 class of the 1960's. The current amphibious ships in production include the LSD 49 and the LHD 5. The LSD 49 is a ship of lesser capability in terms of lift and combat systems, and does not have the secondary aviation capability which is required for LX. The LDH 5 has far more capability than required for LX and is prohibitively expensive to buy in the quantities required for LX. The Defense Acquisition Board reviewed the LX program in January 1993 and determined that the most cost effective solution for the Amphibious Force requirement was the acquisition of the LX class. Since the LX is just starting Phase I Demonstration and Validation, firm allocations for HM&E and combat systems have not been developed.

Question. Will the ship be able to have own ship "over land radar picture," and will it be ship separate or part of a cooperative engagement net? Will the ship require escorts: what kind, why?

Answer. The number and type of radars will be evaluated during the COEA process and will not be finalized until a Milestone II Defense Acquisition Board (DAB) Decision in FY–95. As currently envisioned, LX will have the SPS–49 Air Search radar to provide 2–D target information. This radar has a limited "over land" surveillance capability. These ships are not currently programmed to be part of a cooperative engagement net. The requirement to have an LX class ship escorted would be decided by the operational commander and would depend heavily on scenario, geographic location, and threat level expected. The LX would not be operating in an area unless air superiority had been established.

AEGIS UPGRADE

Question. Please explain the Navy's "Flight IIA" strategy. The budget requests about $104 million for Aegis combat system upgrades. In addition, the Navy has embarked upon a new strategy called "Flight IIA" to lower the cost of future Aegis ships. Your statement indicates that "Flight DDG-51's, scheduled to begin construction in fiscal year 1994, will incorporate several modifications which will reduce costs and emphasize combat capabilities needed for regional conflict."

Answer. The Navy's "Flight IIA" strategy is to comply with the results of a CNO-directed study to define an affordable DDG 51 variant (DDV study) which will replace retiring helicopter-capable battle force combatants. Major additions to the ships include: dual helo facility, Evolved Sea Sparrow Missile (ESSM) (when available), Kingfisher (mine detection software), 6 VLS cells (for a total of 96), organic LAMPS MK-III helo capability, and a general purpose armed helo capability. Major ship deletions include: Close In Weapons System (CIWS) (when ESSM is available), Harpoon, and TACTAS (Tactical Towed Array System). The "Flight IIA" acquisition strategy is to award the last FY 1994 ship (the first Flight IIA ship) to the lead shipbuilder, Bath Iron Works (BIW), and to compete the balance of the FY 1994 ships. Subsequent Flight IIA ships will be competed between the two qualified sources, BIW and Ingalls Shipbuilding. This acquisition strategy introduces Flight IIA ships without interrupting serial production in the class.

Question. What can be done to make Aegis Ships more affordable.

Answer. The Aegis program's affordability initiative (Navy, in conjunction with the shipbuilders and equipment prime contractors) is investigating initiatives that will reduce cost while ensuring that mission critical operational performance is maintained.

Examples include producibility improvements, process improvements, material standardization, test consolidations, and reductions in duplication and distribution of program documentation. The goal is to effect a $30M reduction per ship commencing with the first DDG Flight IIA ship. To date, $21.5M of the $30M cost reduction goal has been identified.

Question. What capabilities are needed for "regional conflict" which are not available from today's AEGIS ships?

Answer. Embarked multifunction helicopter capability to contribute to ASUW, ASW, surveillance, target identification, mine warfare, combat search and rescue, and other warfare area missions. This capability is available on CG-47 class ships.

Kingfisher modification to SQS-53 sonar to aid in mine detection and avoidance.

SPY radar upgrade to improve near-land, clutter, and anti-jamming performance as well as track management. In addition, SPY radar upgrade provides improved radar performance against low RCS, low altitude ASCM targets.

TBMD for AOA, port, and battle group defense against ballistic missile threat.

Cooperative Engagement Capability provides real time, fire control quality track data exchange to ensure joint interoperability in near-land environment. Improves battle force capability in dense jamming, high clutter environments.

Evolved Sea Sparrow Missile (ESSM) improves close-in ship self-defense against maneuvering, high performance ASCM.

Incorporation of advanced sensors for improved target detection and engagement in reduced battlespace environment. Such sensors include Infrared Search and Track (IRST) and Electro-Optical Sight.

Advance degaussing improvements to enhance mine avoidance.

Enhanced shallow water sonar performance.

ID upgrades to provide integrated, identification capability.

Question. The Committee understands that Fleet CINCs strongly desire additional helicopter capabilities on their ships. Why?

Answer. An embarked helicopter adds significant warfighting capability in virtually every mission area. Increased emphasis on near-land operating environments in conjunction with planned force structure reductions, demand flexibility and multimission capability. Both the DDV Study and a recent Institute for Defense Analyses study concluded that embarked helicopters make an essential contribution to surface combatant flexibility and mission success.

The embarked helicopter provides over-the-horizon detection, identification, targeting, and battle damage assessment, most notably against fast attack and missile boat threats as well as submarines. It expands surveillance and battle space, increasing decision and reaction time. Upgrades planned for the SH–60 will enhance its multi-mission contribution. With respect to DDG–51 Flight IIA, the embarked SH–60B gains added value from the synergistic effect of full integration within the AEGIS Combat System. Ultimately, the DDG–51 Flight IIA will provide replacement for over 60 retiring FFG–7 and DD–963 flight decks.

Emphasis on regional, near-land operations are supported by embarked helicopter capabilities in:

Maritime interdiction,
Visit, board and search,
Special warfare operations,
Naval Surface Fire Support,
Anti-mine warfare, Small boat defense, and
Combat search and rescue.
ASW (shallow water)

Question. Explain why the Navy awarded FY 1992 shipbuilding funds for Flight IIA when Congress denied the 1992 new start R&D reprogramming request. Is this legal?

Answer. Modification of DDG 51 to Flight IIA is not a new start. RDT&E costs in FY 93$ (FY 92–99): $98M. Average unit production costs slightly lower than Flight II ships in FY 93$ (FY92–FY99): $30M. OSD is scheduled to conduct a Milestone IV (Major Upgrade) DAB in July, 1993 for Flight IIA DDGs.

Question. What are the total development and program costs for Flight IIA and the new radar upgrade (EDM 4B)?

Answer. For Flight IIA: Development Costs: $88.4M (R&D); Program Costs: $108.1M (SCN)

Note: Costs above are for FY 1994 and beyond. The $108.1M nonrecurring costs will be offset by approximately $30M/ship recurring affordability savings when Flight IIA ship costs are compared to Flight II costs. For EDM 4B: Development Costs: $61.3M (FY 1994 and out R&D).

Question. What is the Navy's acquisition strategy for Aegis upgrades, and will any of these programs be competed?

Answer. Upgrade to Aegis SPY-1 Radar System will be acquired by directed procurements to the current combat system design agent, Martin Marietta Corporation (formerly GE/RCA). There are no anticipated Aegis engineering efforts planned for competition.

Question. The Committee understands that the Navy has agreed with the Strategic Defense Initiative Organization to an anti-ballistic missile defense program based on Aegis radar technology. Please explain the Navy's strategy.

Answer. Results from several independent studies (1991 NRAC, 1991 DSB and a Navy/MIL-LL) concluded that selected Navy AAW systems could be evolved into ballistic missile defense capable programs. For endo-atmospheric ballistic missile interceptor (lower tier) the Aegis radar detection control software has to be modified. Evolution of the SM-2/Blk IV into a multi-mode guided system (RF and IR) along with ordnance package upgrades will provide an interceptor for endo-atmospheric intercept. This evolved approach is referred to as the lower tier Aegis/SM-2 Blk IV A TBMD system. An upper tier system is also proposed for theater (exo-atmospheric) engagements. This approach requires Aegis radar software and hardware modification and a more aerodynamic controlled missile. A cost and operational effective analysis is underway to select the most appropriate sea based upper tier interceptor. The intent is to develop the lower tier endo-atmospheric missile as a multi mission weapon so as to not degrade current anti-cruise missile defense capability.

TOMAHAWK MISSILE UPGRADES

Question. During Operation Desert Storm, the United States used cruise missiles for the first time in combat. The Navy now plans a $564 million Tomahawk upgrade development program, which would be initiated in fiscal year 1994 for $31 million. Admiral Owens, please describe how Tomahawk missiles were used in Operation Desert Storm, and their effectiveness.

Answer. 288 TLAMs were fired from surface ships and submarines. The TLAMS were used against various strategic targets, complementing air strikes. They were the only weapon system used against Baghdad in the daytime and used against high priority targets in heavily defended areas. Both DESERT STORM and the Zaafarinayah strike of 17 Jan 93 (44 missiles) proved without question the effectiveness of the Tomahawk system.

The Center for Naval Analyses is conducting an indepth effectiveness analysis (missile by missile, mission by mission) which is expected to complete in July.

Question. What deficiencies exist that require a new R&D program?

Answer. While the Tomahawk land attack missile proved to be very effective during DESERT STORM, we found that we needed improved mission planning responsiveness and flexibility to take full advantage of the weapon. Current mission planning takes about 40 hours per mission if all data is held at the mission planning center. The Block III program will reduce this to approximately 4 hours and the Tomahawk Baseline Improvement Program (TBIP) will reduce the restrictions on the types of data needed for mission planning. We also found that hard target penetration capability, Battle Damage Assessment/Indication (BDA/BDI) capability, and improved accuracy were required.

Question. Describe the requirements for and capabilities to be provided by a new development program.

Answer. The Tomahawk Baseline Improvement Program (TBIP) was derived from lessons learned in Operation DESERT STORM. The TBIP requirements are for increased lethality/accuracy by incorporating a forward looking autonomous seeker to achieve significantly improved CEP, for more rapid mission planning to meet the Air Tasking Order (ATO) planning cycle requirements, to respond to emergent/relocatable targets, and for penetration capability of targets with up to 10 feet of reinforced concrete. Additionally, inflight communications with the missile to assess effectiveness of strike, acquire imprecisely located targets, re-target or re-direct missile inflight and/or "forward pass" Tomahawk to LAMPS MK-III/TACAIR, is required. TBIP will also provide increased loadout flexibility because it will be capable of anti-ship and land attack missions.

Question. Dr. Whitman, please describe the Navy's acquisition strategy, development and production cost estimates in then year dollars, and the key milestones for this program.

Answer. The Navy's acquisition strategy is to award a competitive cost plus fixed fee contract in FY94 for the Tomahawk Baseline Improvement Program (TBIP) engineering, manufacturing and development effort. McDonnell-Douglas and Hughes Missile Systems Company currently manufacture the Block III missile. The development and production cost estimates will provide for the remanufacture of Tomahawk Anti-Ship Missile (TASM) and Block IIC, Land Attack Tomahawk assets into Block IV missiles. Cost estimates for development include associated mission planning and weapons control system integration costs required to field a complete Block IV capable Tomahawk Weapon System including a follow-on hard target penetrator version. The development budget estimate to complete for FY94–FY99 is $550M (then year dollars). Although the first production TBIP missiles are beyond the FYDP, the Navy estimates that the missile cost will be within 10% of current Tomahawk variants. We are currently refining our developments and production estimates in preparation for the Milestone IV/II review. These Milestone IV/II estimates may exceed the budget estimates provided here. The key milestones for this program are; Milestone IV/II (approval for major system modification to begin engineering and manufacturing development)-August 1993, Contract Award-April 1994, Developmental Test-October 1997, Milestone III (full rate production)-2000, Initial Operating Capability-2000, and follow-on Capability (Hard Target Penetrator)-2001.

AIRBORNE SELF PROTECTION JAMMER

Question. The Navy terminated ASPJ, at the Armed Services Committees' direction, last year after more than 10 years and $1.5 billion of development. Dr. Whitman, what has the government got for its $1.5 billion investment in ASPJ?

Answer. In terms of hardware, the Government has 20 systems that were used in the ASPJ test program and 95 systems that were procured under a low-rate production contract. These systems were delivered prior to contract terminations in December 1992. Less apparent have been the gains made in electronic countermeasures and manufacturing technology. To have achieved the increased electronic capability of ASPJ within the volume that housed less capable predecessor systems is a significant accomplishment that can lend itself to other Government applications.

Question. Please describe the dispute within the Navy about testing which caused the Navy to terminate the program.

Answer. The dispute concerns two areas: suitability and effectiveness. This is more a difference in assumptions used to establish criteria than a technical dispute. As regards suitability, the ASPJ was graded as unsatisfactory because built-in-test software indicated failure more often than the test criteria allowed. Some of these indications were not real failures but false indications. Testers counted hardware and software failure indications to compute the grade whereas others within the Navy understood that only hardware failures would be counted, in which case, the grade would have been satisfactory. In the area of effectiveness, the ASPJ was graded, in one set of conditions, as unsatisfactory because it did not improve aircraft survivability to the degree required by the test criteria. In this instance, because of the use of effective tactics and limitations in the test scenarios, attainment of a satisfactory grade was impossible in some cases. Specifically, an ASPJ-equipped aircraft was to be compared with an aircraft with no jammer flying an identical mission profile. The survivability of the non-jamming aircraft in this case was so high that improvement to the degree required was not possible even with perfect performance from the ASPJ.

Question. What are the implications for the F–14?

Answer. The implications of the ASPJ termination for the F-14D were that this aircraft, as it was about to be evaluated for fleet introduction, was left without a critical, required element, that of a defensive electronic countermeasures system. The Navy saw a way to ameliorate this predicament at minimal cost if it could use the ASPJ systems it had on hand. The following factors weighed heavily in the Navy's decision to pursue employment of the ASPJ in F–14D aircraft: the F–14D had no readily-available alternative to the ASPJ as did the F/A–18 with its ALP–126B; the ASPJ test report recommended continued testing and limited deployment of the ASPJ in the F–14D; and the delivered ASPJ inventory could equip the entire F–14D fleet.

Question. Admiral Owens, does ASPJ work well enough for the fleet to use and do you have a requirement for it?

Answer. Yes to both parts of the question. Although the ASPJ may not be perfect by testing standards, it is better than any other jammer we have and is most certainly better than the F–14D's present alternative: nothing. The requirement still exists and has been validated.

Question. If there were no legislation involved, would the Navy have terminated the program?

Answer. No. The Navy was too close to realizing a return on its investment and fulfilling a long-overdue requirement to have quit. However, the Navy would not have proceeded to any additional production decisions until the testing issues were resolved, the shortcomings identified in testing were corrected, and these corrections were verified in Operational tests.

Question. What does the Navy advocate should be done—absent the restrictive authorization legislation—for the government to obtain some benefit from its $1.5 billion investment?

Answer. The Navy proposes use of delivered ASPJs in F-14D aircraft. This endeavor would be accomplished in three phases: (1) testing the F-14D/ASPJ integration in connection with the upcoming F-14D operational evaluation, (2) installing systems into fleet aircraft after testing is completed, and (3) providing logistic support once the fleet is operating the system. Phase (1) will require: (a) modifying installation racks to the configuration required for testing, (b) finishing F-14D/ASPJ integration, and (c) providing test and engineering support for the test program. Phase (2) will require completing the contract for 55 production installation racks. Phase (3) will require providing logistic support through the system's service life.

Question. Provide for the record the legislative language that would be needed for the Committee to allow you to proceed with ASPJ on a limited basis for the F-14 aircraft.

Answer. The following language is proposed:

"Notwithstanding the provisions of Section 122 of the National Defense Authorization Act for Fiscal Year 1993, the Department of Defense is authorized to use FY 1993 funds and prior fiscal year funds for the following purposes:

(a) Research and Development funds may be used to acquire and modify racks necessary to integrate the ASPJ systems from the existing Navy inventory into the F-14D for operational testing and evolution of the F-14D, and to provide for all support necessary for the required F-14D developmental and operational testing;

(b) Procurement funds may be used to procure racks necessary for integrating the ASPJ systems from the existing Navy inventory for the F-14D, and to provide for all integration/logistic support necessary for such systems."

MANUFACTURING TECHNOLOGY (MANTECH)

Question. The A-12 was a good example of the penalty the government pays when it does not invest sufficiently in manufacturing technology. The Committee has consistently over the last 5 years urged the Navy to increase its MANTECH budget. Dr. Whitman, how much is budgeted in the Navy R&D account for MANTECH?

Answer. DOD has consolidated military department MANTECH programs in a joint DOD account managed by DDR&E (PE 0603705D).

There are no FY 1994 funds in the Navy budget.

Question. What portion of the DOD account belongs to the Navy?

Answer. DOD will be centrally managing MANTECH programs. Some of the DOD funds may be transferred to the Navy for execution, but that amount has not yet been determined by OSD.

Question. What percentage is this compared to what Congress appropriated to the Navy in fiscal year 1993?

Answer. The exact percentage can't be determined at this time, since OSD will determine how much to transfer to Navy.

Question. Given this answer, is Navy MANTECH "broken"?

Answer. No. The MANTECH program has been restructured to focus on DOD's highest priorities, and to respond to the realities of a lower overall budget.

Within the funds available, greater emphasis will be placed on dual use technology and integration with other Navy science and technology efforts.

Question. What is the Navy's plan to continue MANTECH contracts that were funded in fiscal year 1993, given that there are insufficient funds at the OSD level to do so?

Answer. The highest priority efforts will continue to be funded with whatever funds OSD makes available. The lower priority efforts will be terminated.

Question. Please tell the Members which of the projects funded in fiscal year 1993 you plan to terminate, and in what cities and states these projects are located.

Answer. A tentative list of projects is currently being developed for Navy review and coordination with OSD.

Information regarding specific terminations can not be provided until OSD allocates resources to the Navy and other services.

Question. Last year the Committee directed the Navy to strengthen the Navy's MANTECH office commensurate since Congress doubled the Navy's 1993 budget request in the final appropriation. How has the Navy implemented the Committee's direction?

Answer. Management of the Navy MANTECH program has been strengthened by transferring it to the Office of Naval Research.

There is synergy between MANTECH and other ONR programs, including the following:

PE 0602790N:
  Small Business Innovative Research (SBIR)
  Small Business Technology Transfer (STTR)
PE 0602234N:
  Materials, Electronics, and Computer Technology
PE 0603712N:
  Logistics Engineering Advanced
  Demonstrations
  Rapid Acquisition of Manufactured Parts (RAMP)

ONR has science and engineering talent to support MANTECH that was not available in the Acquisition and Policy office of Assistant Secretary of the Navy for Research, Development and Acquisition ASN (RD&A). Goal is to ensure that MANTECH is integrated with other science and technology programs.

Question. Why was the Navy's MANTECH office removed from the Pentagon and relegated to the lower level under the Office of Naval Research?

Answer. Prior to its transfer to the Office of Naval Research, the MANTECH program office was located within the Crystal City complex of buildings, and reported to the ASN (RD&A) via Deputy for Acquisition Policy, Integrity, and Accountability (API&A).

ASN (RD&A) determined that MANTECH programs would be improved by leveraging and aligning its initiatives with Navy science and technology programs. Accordingly, MANTECH's reporting chain within ASN (RD&A) was shifted to the Chief of Naval Research (CNR).

Both Deputy API&A and CNR are on the same organizational level, with the only real change being the move of the MANTECH office from Crystal City to its current location with the Office of Naval Research in the Ballston area.

Question. What plans does the Navy have to expand the work of its centers of excellence?

Answer. The Navy is supportive of the centers of excellence, but declining military budgets are likely to constrain growth and expansion of centers through Navy funding.

As the centers are increasingly stand-alone and viable entities, the Navy hopes that they will be strong contenders for DoD funds under the Defense Conversion and Technology Reinvestment Program, and also would competitively seek funding from private industry for development of dual use technologies with commercial applications.

NAVAL RESEARCH LABORATORY (NRL)

Question. The Committee has long been concerned about unnecessary Navy functions performed in the high cost Washington, DC area. Much attention has been given to the Navy's presence in Crystal City, Virginia. Not much attention has been given to the Naval Research Laboratory (NRL) which spends about $1 billion annually and has about 3,600 civilians and 165 military. Dr. Whitman, why does the Navy need a research laboratory within the Washington, DC beltway?

Answer. NRL is the Navy's corporate laboratory conducting research in all science and technology areas. The Navy recently reaffirmed its need for a multi-spectrum corporate laboratory to support its long-term warfighting requirements. The presence of the Navy's corporate laboratory in Washington is essentially historical, its location and funding having been established by Congressional action. Today, NRL is not just in DC. It has facilities in DC, California, Mississippi, Florida, Maryland and Virginia. One imperative for maintaining NRL's main DC facility is the cost of a move, estimated at $1 billion to replace facilities and fixed scientific equipment, plus cost to acquire land, loss of scientific personnel and disruption of programs. NRL's facilities outside DC are located close to their operational Navy sponsors.

Question. What is the average salary of the employees at NRL?

Answer. $48,416.

Question. How much of the annual $1 billion budget is spent for in-house activities?

Answer. NRL is not funded as a line item in the Navy budget, but is industrially funded on a work reimbursable basis. NRL managed $751 million in FY 1993, approximately 50% of which was spent on in-house research, supplies, materials, and equipment.

About $260 million (35%) is spent for in-house researchers and support personnel, about $114 million (15%) is contracted-out for materials, supplies and equipment for the laboratory, and about $377 million (50%) is spent for R&D contracts to industry and universities across the country.

Question. Has the Navy made any analysis to transfer NRL to any of the excess military sites from the base closure process?

Answer. Yes, all NRL facilities were considered during the Base Closure and Realignment Process.

Question. How long has NRL been in its present location?

Answer. As noted, NRL was established by Congressional action and operations commenced at the DC location in 1923. Other NRL facilities have been in-place for various (but shorter) periods of time.

[CLERK'S NOTE.—End of questions submitted for the record.]

WEDNESDAY, APRIL 21, 1993.

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, AIR FORCE

WITNESSES

LT. GEN. JOHN E. JAQUISH, USAF, PRINCIPAL DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE FOR ACQUISITION

JAMES J. MATTICE, DEPUTY ASSISTANT SECRETARY FOR RESEARCH AND ENGINEERING, OFFICE OF THE ASSISTANT SECRETARY OF THE AIR FORCE FOR ACQUISITION

INTRODUCTION

Mr. DICKS. The Committee will come to order.

We are pleased to have you here today, General Jaquish, and Mr. Mattice. This is the second hearing this afternoon on Research, Development, Test and Evaluation, Air Force. The fiscal year 1994 RDT&E Air Force request is $13.7 billion, which is $496 million above last year's appropriation.

Testifying in support of this appropriation is Lieutenant General John Jaquish, the Principal Deputy Assistant Secretary of the Air Force for Acquisition; and Mr. James J. Mattice, the Deputy Assistant Secretary for Research and Engineering.

Gentlemen, we welcome you. Please proceed with your summary statement. Your prepared statement will be placed in the record.

General JAQUISH. I have no remarks to make at this time other than we are happy to be here and we are ready for your questions.

[The statement and charts of General Jaquish and the biography of Mr. Mattice follow:]

DEPARTMENT OF THE AIR FORCE

PRESENTATION TO THE COMMITTEE ON APPROPRIATIONS
SUBCOMMITTEE ON DEFENSE
UNITED STATES HOUSE OF REPRESENTATIVES

SUBJECT: Air Force Research, Development, Test and Evaluation

STATEMENT OF: LIEUTENANT GENERAL JOHN E. JAQUISH
Principal Deputy Assistant Secretary (Acquisition)

APRIL 21, 1993

NOT FOR PUBLICATION UNTIL RELEASED
BY THE COMMITTEE ON APPROPRIATIONS,
HOUSE OF REPRESENTATIVES

Mr. Chairman and Members of the Committee:

It is my pleasure to appear before you to review and discuss the Air Force's Research, Development, Test, and Evaluation (RDT&E) activities in the Fiscal Year 1994 (FY 94) President's Budget.

Our overall RDT&E budget request recognizes budget pressures and the downward trend of Air Force RDT&E funding in recent years. Air Force RDT&E appropriations have experienced a real decrease of 26 percent between FY 88 and FY 93. Our $13.7 billion FY 94 RDT&E request provides a real increase of approximately one and one-half (1 1/2) percent over the FY 93 appropriation. This modest increase signals our desire to stop the continuing decline of the RDT&E budget. The FY 94 RDT&E request reflects the President's commitment to maintain the technological superiority of our armed forces and contribute to the technological competitiveness of our nation.

The downward path of our past RDT&E budget reflects the movement away from a Cold War mindset and the movement towards preparing for a multifaceted threat dominated by regional conflicts, proliferation of weapons, and the uncertain future of the Former Soviet Union. We are confident in our ability to adjust to the changing security environment and maintain readiness in the face of a shrinking defense budget. However, our success in effectively dealing with potential future threats depends in part on maintaining a healthy RDT&E effort. Desert Storm demonstrated that modern technology helped the United States make its point with remarkable accuracy while minimizing collateral damage. The leverage provided by superior weapon systems is crucial to the Air Force's ability to effectively maintain its readiness while adapting to the changing security environment. Maintaining technological superiority is a dominant priority in our FY 94 RDT&E budget request. We also recognize our responsibility to ensure that our technological advances are made available to benefit the U.S. economy.

Today I'll discuss some of our Science and Technology programs and provide an overview of the efforts associated with our major systems acquisition programs. Air Force programs are divided into specific mission areas which support the objectives of Global Reach--Global Power. I'll discuss each of these areas, update some initiatives underway within Air Force acquisition and wrap up with a conclusion. The areas I'll discuss are:

- Science and Technology
- Sustaining Deterrence: Nuclear Forces/Long Range Power Projection
- Providing Versatile Combat Forces: Theater Operations and Power Projection
- Supplying Rapid Global Mobility/Reach: Airlift and Tankers
- Controlling the High Ground: Space and Command, Control, Communications, and Intelligence (C^3I)
- Other Significant Issues

SCIENCE AND TECHNOLOGY

The goal of our Science and Technology (S&T) Program is to provide the technical foundation of the Air Force Global Reach--Global Power objectives by providing the competitive advantage and maximum war fighting potential of advanced technology. It is difficult to quantify the quality of the technology development program since the results of our investments in S&T are normally not known for 15 to 20 years. However, as demonstrated to the world during the Persian Gulf War, the U.S. produces the most technologically advanced and effective weapon systems in the world. This gives us the edge against any potential enemy and reduces the risk to our own forces. We need to protect this technological advantage, particularly as we move towards a smaller force structure and a more volatile and destabilized world. To maintain superior war fighting capabilities that can be effective in regional and larger conflicts, there is an ongoing compelling need for continued development of a balanced set of technologies for a wide spectrum of weapon systems and combat scenarios.

The Air Force is committed to the S&T Program. The FY 94 budget request provides a balanced S&T Program that addresses both near- and far-term Air Force war fighting needs. We are focusing the S&T Program on technologies that will result in superior weapon systems that are both sustainable and affordable. For example, by applying rigorous reliability and maintainability disciplines in concert with technological advancements, we have developed formidable weapon systems with high readiness rates. During the Persian Gulf War, our A-10s, F-15Es, F-16s, and KC-10s all exhibited 95 percent mission capability rates or more. The overall mission capability rate for Air Force aircraft was over 92 percent. Continued emphasis in the S&T Program on affordability, reliability, maintainability, and producibility is essential to ensure future combat superiority.

While the Cold War competition with the Former Soviet Union has abated and is no longer the primary focus of our technology development, we still face many potential adversaries who have technologically advanced weapon systems which could threaten the U.S. and our allies. The proliferation of technically advanced weapons into the international arms market will further destabilize the current world order. The Persian Gulf War showed that we must work to maintain the tremendous advantages that accrue from being a generation ahead in weapons technology. A continued and substantial S&T Program is required to maintain that advantage. The U.S. response to acts of aggression must be decisive, requiring a technological edge to win quickly and minimize losses. During the Cold War, we were prepared to repel a massive Soviet invasion of Europe. Fundamentally, our goal was to deter first, yet have the needed leverage to win. In potential future regional conflicts, our stake may be less immediate, but political and strategic considerations will still require a decisive outcome. We cannot afford to trade American lives with tyrants and aggressors who do not care about their own people. We must make them fight on our terms. This requires a continuing emphasis on technological superiority.

Military technological advances will continue to pose challenges to our forces both to keep up with emerging technologies and to get the greatest potential from the systems we have. For example, our extensive use of precision munitions in Desert Storm highlighted a requirement for much more detailed intelligence than had been previously available, in near-real-time, to the battlefield commander. It was no longer enough for intelligence to report that a certain complex of buildings housed parts of the Iraqi nuclear program; targeters needed to know precisely which function was conducted in which building, or even in which section of a building. Our Desert Storm experience confirmed the importance of theater command and control, battle management, battle damage assessment, and theater missile defense. The Air Force has focused technology programs to address Desert Storm shortfalls.

We are fully committed to the National Aero-Space Plane (NASP) which is the Air Force's (joint with NASA) "flagship" S&T program. The NASP program will develop the enabling technologies for reusable, runway-launched hypersonic flight and space transportation, providing the Air Force and the nation with options for a new generation of aerospace vehicles. As a major national effort, the NASP program is developing a broad suite of technologies with substantial impact and application, not only in the aerospace industry, but in a variety of other industries. Investment in the NASP program will ensure future global leadership for the U.S. aerospace industries and prevent future strategic technological surprise.

The Air Force has remained steadfast in stressing the importance of quality in our systems, or "maintaining the technology edge" to counter the quantity of enemy weapon systems. Today the balance of enemy weapon systems is shifting from quantity to increasing technological quality so the need for developing advanced technologies remains. Importantly, the Congress has consistently supported our approach of fielding technologically superior weapon systems. The S&T programs are integral to that approach and have a very clear purpose: developing the technologies that will become the cornerstone for future Air Force war fighting capabilities. These programs are about America's security, about deterring war, about winning decisively if war is forced upon us, and about saving the lives of our fighting forces.

The Air Force S&T Program also contributes to the maintenance of the U.S. industrial base by transferring dual-use technology to the U.S. private sector and by adapting commercial products and technologies to meet military needs. For example, our work in turbine engines has revolutionized the commercial airline industry. Composite materials, that were developed to make our aircraft lighter and faster, are now found throughout the commercial sector. The shoulder harness used by car manufacturers was originally developed for fighter aircraft. Furthermore, commercial electronics are being developed that often meet military requirements that would have previously necessitated costly military unique development and production. These are but a few examples, and we will continue these efforts. We are committed to support technology transfer, spin-off, spin-on and dual use technologies. The sharing of information and expertise through technology partnerships involving industry, government and academia, not only benefits the Air Force but the economy as well.

Also Test and Evaluation (T&E) is very important to maintaining superior war fighting capabilities. With advanced technology demonstrators, system prototypes, and applied technology insertion (modifications and planned upgrades), additional testing of existing weapon system platforms will be required. Moreover, as weapon system acquisition continues towards extended development schedules with fewer production units, we see the importance and length of testing increasing. The reason is that with fewer units being procured, increased confidence in their performance and knowledge of limitations must be factored into full-scale production decisions and employment tactics. To better focus on testing, we have our test staff within one Air Force office. Their focus is on producing a test infrastructure investment master plan, consolidating test activities, and centralizing all operational test management in a single location. Our challenge is to match continuing advances in technology and demands on our facilities and people with the requisite test capabilities in this declining budget environment.

SUSTAIN DETERRENCE

NUCLEAR FORCES

The goal of our Nuclear Force programs is to assist in meeting the Air Force Global Reach--Global Power objective of ***sustaining deterrence***. Recent successes in the arms control arena are resulting in significant changes in the strategic landscape. In less than two years, we have removed all of our long range bombers and almost one-half of our intercontinental ballistic missiles (ICBMs) from day to day alert. We terminated the Small ICBM development program, canceled the Peacekeeper Rail Garrison program, and ended production of Peacekeeper missiles. After we deactivate the Peacekeeper ICBMs at the end of this decade, the Minuteman III ICBM will be the only land based element of the Triad on day to day alert. We are conducting an extensive life extension program to keep the Minuteman III fleet viable well into the next century. This will ensure that this nation retains a viable, robust, affordable nuclear deterrent.

First, to comply with START and START II requirements, we are downloading our Minuteman III missiles from their multiple-warhead configuration to a single warhead configuration. Second, we are replacing failing 1960's era guidance electronics, which are predicted to be unsupportable by 1998, with modern, supportable electronics which will minimize life cycle costs. Along with this guidance electronics modernization, we are planning to develop an advanced inertial measurement unit (IMU) to allow us to maintain the accuracy of our ICBM fleet after retirement of the Peacekeeper begins in 2000. The advanced IMU will also allow for semi-dormant operation to maximize alert force flexibility available to national leaders, and further improve reliability, maintainability, and nuclear safety. Next, our Propulsion System Replacement Program will lead to the remanufacture of all three solid fuel stages to correct age-related degradations and to maintain system reliability and viability. We are continuing development of the Minimum Essential Emergency Communications Network (MEECN) program to upgrade and enhance command and connectivity links with all U.S. Triad nuclear forces. We will also complete development and begin deploying the Rapid Execution and Combat Targeting (REACT) Program to replace unsupportable ICBM launch control equipment.

The changing requirements of deterrence allow us to shift many of our bombers from nuclear to conventional missions, while sustaining the bomber force as a crucial part of the Triad. In keeping with the need to hold selected high-value targets at risk, the Advanced Cruise Missile (ACM) will complement the U.S. bomber force as a hedge against unanticipated changes in the strategic equation.

PROVIDE VERSATILE COMBAT FORCES

THEATER OPERATIONS AND POWER PROJECTION

Our theater operations and power projection programs help meet the Air Force Global Reach--Global power objective of ***providing versatile combat forces.*** Our acquisition strategy responds to the changing world security environment by reducing the rate at which we develop and procure weapon systems. The FY 94 RDT&E budget request reflects our basic investment philosophy that we must maintain a technological edge in the most essential elements of our forces -- even while we streamline our force structure. Our theater operations and power projection programs ensure that we maintain our technological edge by modernizing our forces with versatile weapon systems vital to our ability to respond to the wide range of threats we may encounter. Future wars will likely be of short duration, high intensity, and "come as you are." Technologically superior air power is a necessity in the leaner, meaner Air Force of the future.

Theater/Contingency Forces

Control of the air is the first concern of any joint force commander. It permits freedom of maneuver in all aspects of land and naval operations. It protects the lives of ground forces, restores tactical surprise to the battlefield, and deprives the enemy of sanctuary. To ensure that our country maintains the capability to win decisively, quickly and with minimum casualties, we must continue to fully fund the Engineering and Manufacturing Development (EMD) of our number one fighter modernization program -- the F-22 Advanced Tactical Fighter. The FY 94 RDT&E request will fund the most design-intensive phase of the program, leading to a Critical Design Review (CDR) in late FY 94.

Our post Cold War analysis shows that the principal threat of the 21st century will employ increasingly sophisticated weapons at a time and place that will be difficult to predict. The U.S. must plan for modern threat capabilities that have proliferated and caused changes to regional stability, especially as they approach parity with existing U.S. systems. The F-22 is a keystone of the Air Force's long-term investment strategy to accomplish U.S. National Security Objectives efficiently and affordably. The F-22 has an advanced design to ensure a decisive U.S. advantage and helping to ensure survivability as well as simplifying aircraft maintainability and supportability. These qualities will make the F-22 our air superiority fighter for the next 40 "plus" years.

To effectively employ our existing forces across a wide spectrum of potential threats, we must continue to maintain the safety, survivability and effectiveness of our reduced fighter force, the F-15 and the F-16. Our budget request funds essential upgrades to these aircraft.

Looking to the future, with the Navy as the lead service, we have jointly developed a common operational requirement for the A/FX long range interdiction and attack aircraft. While the Air Force's requirement for this aircraft is not as urgent as the Navy's, we will ensure it will meet our requirements for a phased replacement of the F-111, F-117, and F-15E aircraft. We have offered to work with the Navy to investigate the feasibility of a joint program for a highly-common Air Force, Navy and Marine Corps multirole fighter in the future.

Air Force conventional weapons RDT&E can be highlighted by one phrase -- ***joint services programs***. We are working hand-in-hand with the Navy on several projects to enhance both Services' capabilities while minimizing costs of technologically superior weapons systems. The Advanced Medium Range Air-to-Air Missile (AMRAAM) pre-planned product improvement (P^3I) program continues. In FY 94 we will begin flight testing of the compressed carriage missile for advanced fighters and continue our work in increasing the missile's lethality and ability to out-smart advanced countermeasures. In cooperation with the Navy as lead service, we are requesting funds to support the competitive concept demonstration of evolutionary improvements to the

AIM-9M short range missile. In the air-to-surface arena, the Joint Direct Attack Munition (JDAM) will provide precision munition accuracy in adverse weather/environmental conditions from medium and high altitudes and will be available on most Air Force and Navy aircraft. JDAM will initially upgrade existing 2000 pound bombs, integrating them with Inertial Navigation System/Global Positioning System (INS/GPS) guidance kits, and will eventually add further guidance improvements. We plan to begin a two-contractor competitive effort for the detailed design and manufacturing processes development in FY 1994. The Tri-Service Standoff Attack Missile (TSSAM), as the centerpiece of our standoff munition procurement efforts, brings together all essential elements -- low observability, standoff range and true launch and leave capability -- needed to maximize survivability of launch platforms. FY 94 RDT&E efforts support the Air Force's long lead decisions and continue integration with Navy and Army platforms.

Bombers

To ensure U.S. global power projection capability, the Air Force must maintain a robust and modern heavy bomber force for the nuclear and conventional roles. The bomber force must be able to deliver modern, accurate, and precise weapons, operating either from U.S. bases or from forward deployed locations. The Air Force Bomber Roadmap, delivered to Congress in June 1992, outlined a plan for completing B-2 procurement and modernizing the B-1 and B-52H to hold the entire target base at risk and to ensure U.S. Global Reach--Global Power into the twenty-first century. Under this plan, the highly survivable B-2 will be used against the most valued and heavily defended targets; the B-1 will operate in both penetrating and standoff roles against all but the highest threats, and the B-52 will operate primarily in low-threat areas and/or as a standoff weapons platform.

The B-2 remains the pivotal element in the Air Force's Bomber Roadmap for the future. Only the B-2 will be capable of penetrating and attacking the most heavily defended targets on day-one with precision-guided munitions. The B-2 will destroy the most highly-valued targets with, or without, supporting forces, while minimizing risk, reducing collateral damage and leveraging our leadership in technology. The B-2's long range, large payload, and high survivability make it a logical choice as the power projection instrument of future national policy.

The B-2 program is well on its way to providing the U.S. a fully operational 20 aircraft fleet. The development and production effort has matured to the point that the final production aircraft are anywhere from 25 percent to 44 percent complete. Due to termination costs and expenditure rates, if the decision were made to stop at 16 aircraft, we'd save less than $1.0 billion, or about 3 percent of total program dollars. Eighty-six percent of the money needed for the 20 aircraft fleet has already been appropriated. With so little to be saved and so much of the funding already appropriated, the prudent action now is to provide funds to complete this national effort.

The B-1 will be the conventional workhorse of the bomber force. These 95 aircraft, formerly focused primarily on nuclear war fighting, will be modified to employ a wide range of modern conventional weapons in diverse future threat environments, and will be provided with supportability improvements for overseas conflicts. These lethality, survivability, and supportability improvements will be phased in over the next ten years. The FY

94 request for RDT&E will be used for risk reduction on the defensive avionics upgrades, and for development of cluster bomb unit and Joint Direct Attack Munition (JDAM I) integration. The B-1 conventional upgrade program will build on the aircraft's demonstrated performance records and capability to provide theater commanders the flexibility to use the B-1 in a variety of scenarios. The B-1 will be able to provide a rapid response to conflicts anywhere on the globe, delivering large payloads to blunt the enemy's attack. The bombers can operate alone from U.S. bases in the initial phases of conflict, and then integrate with force packages to provide mass and reach to theater commanders in longer term deployments. The B-1's unique characteristics -- large payload, high/low altitude capability, long range, and fighter-equivalent speed -- will, when coupled with the planned lethality, survivability, and supportability upgrades, make it the backbone of the U.S. heavy bomber force.

To comply with START limitations, half the B-52Hs will retain a nuclear role and half will be modified for conventional operations. Although capable of carrying a wide range of conventional munitions, these versatile bombers will be equipped as a standoff platform for employing precision weapons. Necessary R&D for conventional conversion has largely been accomplished and what remains is to procure and install the necessary modifications.

SUPPLYING RAPID GLOBAL MOBILITY

AIRLIFT AND TANKERS

The goal of our airlift and tanker programs is to help meet the Air Force Global Reach--Global Power objective of ***supplying rapid global mobility***. The Mobility Requirements Study (MRS) strongly supports completion of the C-17 program. The direct delivery capability, ground maneuverability, and cargo off-load efficiencies make the C-17 the logical choice to improve the airlift component of strategic mobility and meet future requirements. The C-17 will provide significantly improved capability to project power worldwide. In addition, the current workhorse of the strategic airlift fleet, the C-141, is rapidly approaching the end of its useful service life (45,000 hours). Without a replacement aircraft, this nation's ability to project forces worldwide will be greatly curtailed.

The C-17 accomplished its first flight on September 15, 1991. Since then, five production aircraft have been delivered to the test program and as of 31 March, the C-17 has flown 1165 hours in 335 missions. To date, flight and ground tests have gone well but have progressed slower than originally planned. Our RDT&E request for FY 94 has increased from last year's President's Budget primarily to cover these flight test delays and the added requirements for live fire testing. While the majority of the development effort is behind us, a substantial amount of testing remains.

Trainers

The Joint Primary Aircraft Training System (JPATS) is a new start for FY 94. JPATS is a joint USAF/USN program to acquire replacement Undergraduate Pilot Training primary training aircraft with the USAF as the lead service. The Services also plan to acquire a Ground Based Training System (GBTS) for the aircraft that includes flight simulators, task trainers, courseware, computer based instruction, and a student training management system.

CONTROL THE HIGH GROUND

SPACE AND C^3I

The goal of our Space and C^3I systems is to assist in meeting the Air Force Global Reach--Global Power objective of ***controlling the high ground***. These systems play a central role in preserving the peace and protecting U.S. national security. U.S. armed forces are dependent upon the combat support provided by these systems to increase their operational effectiveness.

Space systems facilitate global power projection, and provide the National Command Authorities and Combatant Commands with significant advantages in the event of future crises or conflicts. These systems contribute to crisis response by providing tactical warning, communications, navigation, environmental monitoring, and surveillance information. In addition, these systems will support both the initial deployment and the sustainment of forces deployed to areas without an infrastructure for supporting military operations. Consequently, effective execution of United States National Military Strategy and military operations requires space capabilities.

Our first priority during the 90's will be to sustain the operational space systems critical to our users. Second, we will continue ongoing deployment of new systems, ensuring they fit into our overall Defense strategy to meet final operating capabilities. Last, we will pursue research and development efforts toward satisfying new mission needs with space systems where the investment will have significant payoff, where the programs have been shown to be absolutely essential to counter new threats, and where they will leverage the declining force structure.

Our Defense Satellite Communications System (DSCS), Defense Support Program (DSP), and the Defense Meteorological Satellite Program (DMSP) are mature systems the Defense Department depends on for communications, missile warning, and environmental monitoring. Our goal is to provide replacement spacecraft as on orbit assets reach the end of their useful life. While most of this work is accomplished using procurement appropriations, FY 94 RDT&E funding is a critical element in sustaining these systems. For example, we will explore opportunities for international cooperation with the United Kingdom and France in our next generation of DSCS spacecraft. We believe that a joint program offers opportunities for investment cost savings and improved interoperability with our allies. We are continuing development of a small tactical terminal that will provide meteorological data directly to the Air Force and Army mission planners who can best exploit the data. Current technology will allow us to miniaturize this capability from 26,000 pound units of the Desert Storm era to 700 pound systems to be fielded in 1995.

Our Global Positioning System is progressing towards its initial operational capability later this year and towards a final operational capability in 1995. High reliability, high precision, all weather navigation and time will soon be available 24 hours a day on a world wide basis to users with hand held terminals costing less than $1300. This new, fully military capable, Global Positioning Service receiver comes to us without major RDT&E development, leveraging high productivity commercial equipment in a non-developmental item acquisition approach. This innovative approach challenged competition and drove the winning bidder to manufacturing techniques that will eventually drive prices of the terminal to less than $900. We continue to leverage commercial units for airborne and other applications as well.

Milstar continues toward its first launch in late summer 1993, fully compliant with our agreements on restructuring the program. The Air Force has deferred its requirements for production of bomber and launch control center based Milstar terminals, further decreasing the costs of the program. We intend to continue to pursue technologies that bring down the cost of both the space and terminal segments of Milstar.

Our newest program, the Follow-on Early Warning System (FEWS) -- some of you may refer to it as the improved, space based, tactical warning and attack assessment system -- received strong support from the Defense Acquisition Board and was fully funded as we prepared our future years' defense program budget. The program, in its first year of Demonstration and Validation, is in the process of verifying the producibility of technologies necessary for the performance we need from a successor to our current missile warning system. We will review our progress this summer in a Defense Acquisition Board review and expect to complete this phase of the program and begin engineering and manufacturing development in 1994. The Follow-on Early Warning System is a critical ingredient in sustaining current DSP capabilities and increasing performance to respond to the continued international proliferation of tactical ballistic missiles.

Integral to sustaining our space force structure is continued, assured access to space through the procurement and operation of additional Delta, Atlas, and Titan launch vehicles. Modifications to keep these vehicles viable are funded. Their support infrastructure has inherent limitations which preclude cost-effective improvements in reliability, responsiveness or operability. We will continue to study options that would lead to development of a modern Spacelift capability. In this budget submission you will also see continued emphasis on modernization of our launch infrastructure to ensure its viability into the next century.

While our budget and programs are often defined by the systems mentioned above, we are continuing to seek better ways of doing business to eliminate duplication and overhead. We have consolidated 13 separately defined efforts comprising USAF in Military Satellite Communications into a single, joint program office that will give customers throughout the Department of Defense "one stop shopping." We did this to ensure that the Air Force could respond effectively to the changing customer base and mission needs of the armed forces. Similarly, we intend to consolidate, in the weeks ahead, our two early warning program offices into a single space based tactical warning and attack assessment program office. This will help us ensure a smooth and efficient transition as we move from an era dominated by the Defense Support Program towards the capabilities of the Follow-on Early Warning System. We have begun discussions with the National Oceanographic and Atmospheric Administration (NOAA) on the potential for further consolidation of their Polar Orbiting TIROS weather satellite program and our own Defense Meteorological Program. Our investigation reflects future opportunities in life cycle cost savings as each agency considers the need for development of replacement satellites for our operational environmental satellite systems. We continue to challenge ourselves and our customers to consider less costly alternatives to ongoing programs and products.

To manage the theater battlefield, now and in the future, the Air Force continues development of Joint STARS and AWACS. These two systems represent the world standard in real-time targeting and battle management for any type conflict. Joint STARS, a joint Air Force and Army program, is currently on schedule in engineering and manufacturing development with a low-rate initial production decision planned in FY 93. Essential improvements to AWACS will improve reliability and maintainability, upgrade electronic counter-counter measures, improve man-machine interface and increase radar sensitivity to ensure effectiveness against evolving threats.

In FY 93, the Air Force designated the Contingency Theater Automated Planning System (CTAPS) as the core command and control element of the Theater Battle Management architecture. Beginning in FY 94, development of CTAPS will provide automated decision tools to assess the battlefield situation, develop target lists, plan air task orders, monitor mission execution and conduct dynamic replanning in support of the air campaign. The architecture will be designed as an open, flexible system, allowing maximum use of off-the-shelf hardware and software. CTAPS is also building in automated interfaces to the other services.

OTHER SIGNIFICANT ISSUES

To this point we have addressed policy expenditures related to major RDT&E activities proposed in the FY 94 Air Force Budget. We would like to conclude with some remarks regarding the elements essential to successful Air Force acquisition: people, management, and the United States' industrial base.

The Air Force embodies extraordinarily talented civilian and military professionals who complement each other in the management, control, and operation of large and small programs alike.

The last year has seen steady progress in implementation of the Defense Acquisition Workforce Improvement Act. Opportunities for advancement into senior acquisition positions, once the exclusive domain of the military, are being made available to civilians. We are structuring the career advancement programs to ensure that all our personnel will receive the education/training and experience necessary for advancement in the acquisition environment. Funding for this vital acquisition corps program is an important consideration in our FY 94 budget request.

We have also made notable improvements in the Air Force acquisition management process since beginning implementation of recommendations contained in the DOD Defense Management Report. We have significantly streamlined our acquisition management process by delayering, divesting, and consolidating -- doing business more like private industry. As part of that process, on July 1, 1992, we activated Air Force Materiel Command, a consolidation of Air Force Systems Command and Air Force Logistics Command. The creation of the single acquisition headquarters facilitated the implementation of the Integrated Weapon System Management concept -- cradle-to-grave management of acquisition programs. We are in the process of consolidating over 800 acquisition programs into just over 100 so that all segments of a program are under the oversight of a single manager. We have consolidated laboratories and maintenance depots as a further method of appropriately structuring our acquisition organization. We are condensing Air Force acquisition policy from over 35 regulations into one supplement to DoD Instruction 5000.2. These and other improvements are bringing the Air Force acquisition process in line with the changing defense and budget environment.

Our acquisition process and the FY 94 budget request reflects an area of central concern: maintenance of the United States' defense industrial base. A healthy industrial base is vital to our nation's continued security. Industrial capabilities, including those found in government and private/industry laboratories and universities, significantly contribute to national security. To sustain these capabilities, we in Air Force acquisition are emphasizing two initiatives. Our strategy focuses on changing contracting practices to foster integration between military and civilian business requirements and on structuring acquisition plans to minimize the impact of acquisition decisions on the health of the U.S. industrial base. These initiatives are leading us to improve our own practices by encouraging the use of commercial technologies, manufacturing processes, products, and other commercial business approaches. We also are conscious of the importance of maintaining an adequately skilled work force to preserve the industrial base which is critical to this nation's technological and military superiority.

Across the Air Force, and this certainly includes acquisition, we are looking at what is really needed -- and then taking action to make changes -- in organization, force structure, and acquisition practices and plans. We believe that research and development, including a robust science and technology program, is of vital importance to maintaining Air Force readiness now and in the future while at the same time offering potential benefits to the U.S. economy.

CONCLUSION

In view of the nation's budget challenges, we are approaching the point when levels of Air Force funding for RDT&E may not allow us to sustain or attain the kind of technological progress that has provided us with superior weapons systems that give us the edge for decisive victory -- militarily and economically. In this present budget atmosphere, it is crucial that we remember that technological, scientific, and engineering progress involves sustained efforts over long periods of time with attendant budgetary commitments that often extend beyond the point of either initial application or commercial viability. And even though the payoffs are not immediate, to ensure a strong defense posture within budget and manpower constraints, it is our collective responsibility to allocate adequate military expenditures to RDT&E.

Thank you, Mr. Chairman, for the opportunity to make this statement. I will be happy to answer your questions.

ASSISTANT SECRETARY OF THE AIR FORCE
(ACQUISITION)

PRESENTATION TO

HOUSE APPROPRIATIONS COMMITTEE

SUBCOMMITTEE ON DEFENSE

HEARING ON AIR FORCE RESEARCH,
DEVELOPMENT, TEST & EVALUATION

21 APRIL 1993

SAF/AQ

Lieutenant General
John E. Jaquish
Principal Deputy for Acquisition

Mr James J. Mattice
Deputy Assistant Secretary
(Research and Engineering)

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Air Force Vision for the Future
Quality Air Force

Air Force People Building the World's Most Respected Air and Space Force ... Global Power and Reach for America.

Air Force Mission

The Mission of the Air Force is to Defend the United States through Control and Exploitation of Air and Space

Air Force Roles

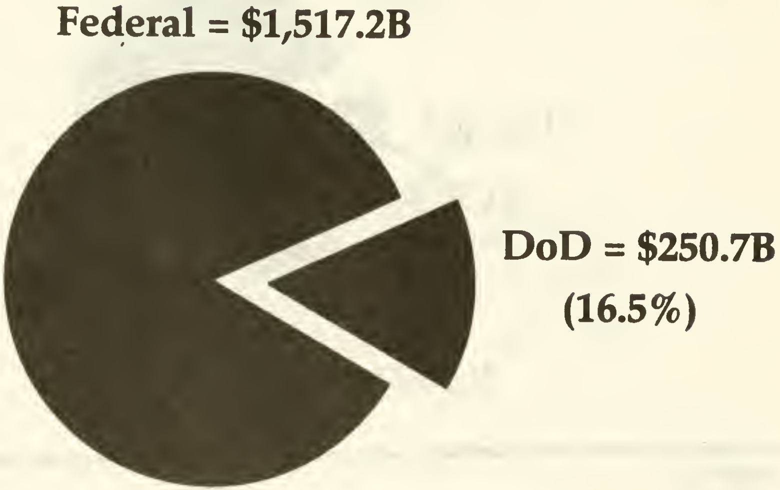
- Aerospace Control (Control the Combat Environment)
  - Counterair
  - Counterspace
- Force Application (Apply Combat Power)
  - Strategic Attack
  - Interdiction
  - Close Air Support
- Force Enhancement (Multiply Combat Effectiveness)
  - Airlift
  - Air Refueling
  - Spacelift
- Force Support (Sustain Forces)
  - Base Operability & Defense
  - Logistics
  - Combat Support

Four Principals of DoD Acquisition Policy

SECRETARY OF THE AIR FORCE ACQUISITION

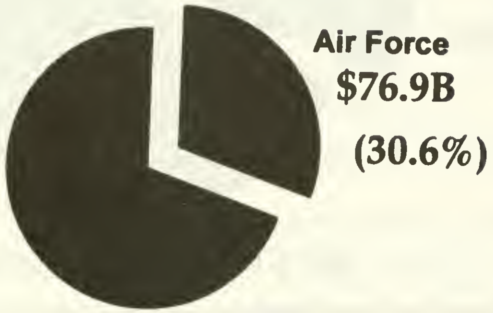
- Selectively Upgrade Existing Systems
- Selectively Procure Existing Systems at Low Rates
- Rollover-plus--Continuous Process of Development & Prototyping for New Systems
- Silver Bullet Procurements--A Strategy where Limited Quantities of High Technology New Weapon Systems with Revolutionary Capabilities are Procured

FY94 Federal/DoD Budget Requests



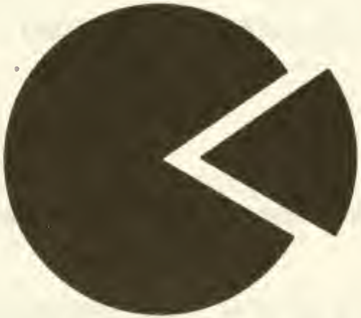
FY94 DoD/AF Budget Requests

DoD Request = $250.7B



FY94 Air Force/RDT&E Requests

AF Request = $76.9B



Air Force Roles

- Aerospace Control (Control the Combat Environment)
  - Counterair
  - Counterspace
- Force Application (Apply Combat Power)
  - Strategic Attack
  - Interdiction
  - Close Air Support
- Force Enhancement (Multiply Combat Effectiveness)
  - Airlift
  - Air Refueling
  - Spacelift
- Force Support (Sustain Forces)
  - Base Operability & Defense
  - Logistics
  - Combat Support

F-22
FIGHTER PROGRAM

CHARACTERISTICS

- Highest Priority Fighter Modernization Program
    - Replaces 1970s Era F-15
- Air Superiority Needed to Allow Freedom of Maneuver For Land, Sea, and Air Forces
- Leverages Effectiveness of Other Operations
- Maintains U.S. Lead in Fighter Technology
- Advanced Integrated Avionics
- Superior Maneuverability Coupled with Reduced Observability
- Greater Range
- Significantly Reduced Cost of Reliability, Maintainability, Supportability

SCHEDULE

● EMD Start	Aug 91
● Preliminary Design Review	Apr 93
● Critical Design Review	Aug 94

F-22 FIGHTER PROGRAM
RDT&E

FY94 FUNDING	**$2,251.0M**
● Air Vehicle	$1264.1
● Avionics	$642.6
● Engine	$259.4
● OGC/SBIR	$84.9

FY94 OBJECTIVES

- Complete Air Vehicle Critical Design Review
- Complete Initial Production Readiness Review
- Finalize Flying Test Bed Configuration
- Fabricate/Test/Build Support System Equip.
- Continue Development Of Block 0 Software
- Conduct Training System Integration Prelim. Design Review
- Continue Assembly Of First Eng. & Mfg. Devel. Aircraft
- Begin Fabrication Of Static Test Article

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	3,976.3	1,606.8	1,925.2	2,251.0	8,942.1	18,701.4

CHEYENNE MOUNTAIN UPGRADE (CMU)

CHARACTERISTICS

- Modernizes & Upgrades Air/Space/Missile Attack Warning Computers/Communications Processors at Cheyenne Mountain AFB, CO
- Provides Air/Space/Missile Warning to Unified and Specified Commanders and National Command Authorities (NCA)
- Provides Backup Cheyenne Mountain Correlation Center at Offutt AFB, NE
- Provides Survivable Comm Interface for Missile AttackWarning Data

SCHEDULE

● Command Center Processing and Display System-Replacement (CCPDS-R) Common Subsystem (Cheyenne Mountain) IOC *	Sep 93
● Communications System Segment Replacement (CSSR) / other CMU Systems Interface IOC	Dec 94
● CCPDS-R IOC	Dec 94

* IOC=Initial Operating Capability

CHEYENNE MOUNTAIN
RDT&E

FY94 FUNDING	**$141.8M**
● CMU Project	$131.1
● Survivl Comm Integ Syst (SCIS)	
● Comm Syst Seg Repl (CSSR)	
● SPADOC 4C	
● CCPDS-R	
● Granite Sentry	
● Alt. Process & CorrelCntr	
● Integrated Tactical Warning/Attack Assessment (TW/AA) Project	$10.7

FY94 OBJECTIVES

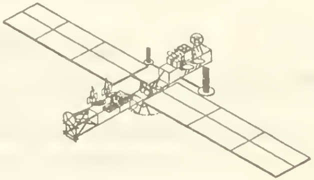
- Continue SCIS Software Development; Install System at 8 Sites
- Complete CSSR Tech Control Subsystem Interfaces With Other CMU Systems
- Continue SPADOC 4C Software Development
- Conduct DT&E on CCPDS-R STRATCOM Subsystem
- Complete Granite Sentry Air Warning Software
- Complete Installation of CMU Systems for Alt Missile Warning Center at Offutt AFB
- Continue Resolution of CMU Interfaces with Over 30 Other TW/AA & Comm. Systems

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	806.4	133.0	151.1	141.8	Cont.	Cont.

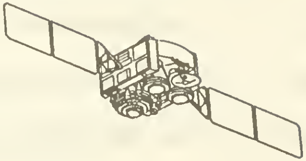
UNCLASSIFIED

MILSATCOM PROGRAM

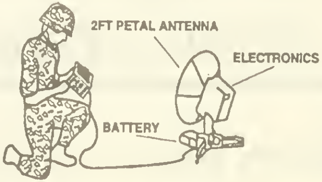
Milstar Space and Mission Control
Lockheed (Prime)
TRW (Payload)
Hughes (Crosslinks)



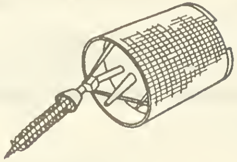
Defense Satellite Communications System
General Electric (Prime)



User Equipment -- Multiple Contracts
Raytheon & Rockwell -- CPT & SMART-T
GE & Lockheed -- SCAMP



Polar Adjunct
Configuration TBD



UNCLASSIFIED

MILSATCOM

Warfighting Space Communication Systems

CHARACTERISTICS

- Supports the DoD MILSATCOM Architecture.
- Satisfies Validated Hardcore, Core and General Purpose Requirements.
- Provides Flexible, Worldwide Coverage for Tactical and Strategic Users.
- Highly Mobile to Large High Capacity User Equipment.

SCHEDULE

● Command Post Terminal Buy-out	Mar 93
● DSCS/IABS Launch	May 93
● Milstar (M*)MDR PDR	Jun 93
● M* Polar Adjunct Review	Aug 93
● DSCS/IABS Launch	Sep 93
● Launch M* Satellite One	1993
● M* Polar Adjunct DAB	1994

JOINT WARFIGHTING
COMMAND AND CONTROL

MILSATCOM RDT&E

FY94 FUNDING	**$1,011.5M**
• Satellites	$902.5
• Mission Control (MC)	$23.1
• EHF/UHF Terminals	$85.9

FY94 OBJECTIVES

- Test First Milstar Satellite On-orbit.
- Launch Second Milstar Satellite.
- Develop, Fabricate and Integrate Milstar Satellites #3 and #4.
- Improve DSCS Satellites and Ground Control for Operations Deficiencies.
- Begin Polar Adjunct Development.
- Continue Milstar MC Development.
- Develop UHF Terminal Modifications and Milstar Terminal Interfaces.

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	5,121.4	985.9	1,125.6	1,011.5	12,840.5	21,084.9

Air Force Roles

- Aerospace Control (Control the Combat Environment)
  - Counterair
  - Counterspace
- Force Application (Apply Combat Power)
  - Strategic Attack
  - Interdiction
  - Close Air Support
- Force Enhancement (Multiply Combat Effectiveness)
  - Airlift
  - Air Refueling
  - Spacelift
- Force Support (Sustain Forces)
  - Base Operability & Defense
  - Logistics
  - Combat Support

B-1 LONG RANGE COMBAT AIRCRAFT

CHARACTERISTICS

- Designed for Nuclear and Conventional Role
- Long Range, Heavy Payloads
- Premier Low Altitude Penetrator

- Becoming the Conventional Workhorse
- Global Firepower on Short Notice
- Accurate and Precise Advanced Weapons Will Improve Effectiveness

SCHEDULE

● IOC	Sep 86
● Began Nuclear Alert	Oct 86
● 100th Aircraft Delivered	Apr 88
● Conventional Bomber Roadmap	Jun 92
● B-1 Four-Star Summit	Sep 92
● OSD Review	Feb 93
● RFP Release (Integrator)	Apr 93
● ECM EMD Start	Late 94

B-1
RDT&E

FY94 FUNDING	$93.5M
● Electronic Countermeasure (ECM) Upgrade	$7.2
● Conventional Weapons Upgrade	$86.3

FY94 OBJECTIVES

- Complete ECM Risk Reduction Efforts
    - **Release Request for Proposal for ECM Eng. Mfg. Devel. Start**
- Continue Development
    - **CBU Integration Development**
    - **Prepare for Flight Testing**
    - **MIL STD 1760 Interface**

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	n/a	0.0	80.6	93.5	TBD	TBD

B-2

CHARACTERISTICS

- Multi-capable Manned Strategic Penetrator
  - Capability to Conduct Missions Across the Spectrum of Conflict
  - Can Support Nuclear War, Conventional Conflicts, and Peacetime Crises
- High Probability To Penetrate Due to Stealthy Design
- Exceptional Range Capability
  - High Mission: 6,000 nm
- Exceptional Payload Capability
  - Approximately 48,000 lbs of Conventional (CBU, TSSAM, JDAM, MK82, MK84)
  - 16 B61/B83 Capable

SCHEDULE

- Recent Major Schedule Changes Reflect President Bush's 28 Jan 92 State of the Union Address
- Air Combat Command First Delivery Dec 93

B-2
RDT&E

FY94 FUNDING	$790.5M
Aeronautical Vehicle	$280.2
System Test & Eval	$171.6
Peculiar Support Equipment /Data/ Training	$107.5
Government Test	$79.3
Engineering Change Order	$45.0
Other	$106.9

FY94 OBJECTIVES

- Flight Test and Data Evaluation
- Test Program Sets, Weapon System, Mission, and Maintenance Trainers, Depot and Organizational Level Data Development
- Combined Test Force Support
- Incorporate Changes into Development Aircraft
- Lab Utilization, Facilities, GPS, MILSTAR UHF, TSSAM, Test Instrumentation, Classified Activities (30.0)

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	18955.1	1522.3	1189.3	790.5	1754.8	24212.0

F-16
Fighting Falcon

SECRETARY OF THE AIR FORCE • ACQUISITION

CHARACTERISTICS

- One of the Largest Air Force Procurement Programs in History
- Currently Serving in 18 Air Forces
- Multinational Coproduction
  - Thirteen Countries
  - Four Assembly Lines
    - Turkey
    - The Netherlands
    - Ft Worth
    - Belgium
    - Korea (1996)
- Workhorse of Desert Storm
  - 249 Aircraft Deployed
  - Approx 13500 Sorties Flown
  - 5 Combat Losses
  - Carried 40% of Bombs Dropped

SCHEDULE

● Program Initiation	Aug 71
● Initial Operating Capability	Oct 80
● First Block 50 Delivered	Oct 91

F-16
RDT&E

FY94 FUNDING	$116.9M*	FY94 OBJECTIVES
● Modified Modular Mission Computer (MMC)	$51.0	● Develop/Integrate Modified MMC for Block 50
● Mid Life Update (MLU)	$27.3	● Develop/Integrate Modified MMC for MLU, Improved Radar, Advanced Avionics System, Digital Terrain System & Cockpit Enhancements
● Mission Support	$12.3	● Provides In-house Support, Testing, Fees for Services, & Radar/Electronic Counter-Countermeasures Enhancements
● CAS Block 40/30	$21.9	● Develop/Integrate Block 40 Aircraft with Improved Data Modem (IDM), VHF Anti-Jam Radio, Missile Warning System, and Night Vision Goggles. For Block 30: Pave Penny, IDM, VHF Anti-Jam Radio, 30mm Gun Pod

* NOTE: $4.4 M in FY94 funding is currently held in PE27133 that will be used to perform feasibility studies for a follow-on Multi-Role Fighter.

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	1,412.7	147.6	109.4	116.9*	849.6	2,636.1

JOINT SURVEILLANCE TARGET ATTACK RADAR SYSTEM (JSTARS)

CHARACTERISTICS

- A Joint AF/Army Airborne System that Finds and Tracks Moving/ Fixed Ground Targets
- Radar Data Used to Cue AF/Army Attack Assets in Near Real Time
  - Common view of the Battlefield
- Pre-Hostility Information from Joint STARS Provides Advance Warning of Enemy Intent

SCHEDULE

● Contractor Flight Test Start	May 89
● Desert Storm Deployment	Jan 91
● Start Syst Level Perf Verif	Oct 91
● Start Government DT&E	Nov 91
● DAB Review for LRIP	3Q FY93

Joint STARS RDT&E

FY94 FUNDING	$295.2M
● Major Contract	$217.3
● Support Contracts	$24.0
● In-House Support	$4.0
● GFE/Other	$49.9

FY94 OBJECTIVES

- Complete Modification of the Third Test Aircraft
- Continue Government DT&E
- Continue Development of Phase I Ground Support Systems (GSS); Phase II GSS Software Support Capabilities Development Begin

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	1,470.9	307.4	313.5	295.2	1,130.3	3,517.2

Minuteman III Life Extension

SECRETARY OF THE AIR FORCE ACQUISITION

CHARACTERISTICS	SCHEDULE
● Rapid Execution and Combat Targeting	● Launch Control Center Upgrade
● Guidance Replacement Program	● Replaces Failing 1960's Technology ● Maintain Alert Reliability Beyond Late 90's
● Propulsion Replacement Program	● Maintain Alert Reliability ● Lower Life Cycle Costs ● Environmental Compliance
● Single Reentry Vehicle	● START Compliance
● Dual Frequency MEECN Receiver	● Communications System Upgrade

Minuteman III Life Extension RDT&E

FY94 FUNDING	$165.5M
● Rapid Execution and Combat Targeting (REACT)	$26.2
● Guidance Replacement Program (GRP)	$87.4
● Propulsion Replacement Program (PRP)	$49.9
● Single Reentry Vehicle (SRV)	$2.0
● Dual Frequency MEECN Receiver (DFMR)	$0.0

FY94 OBJECTIVES

- Continue Software Development
- Design, Review and Test Hard/Software
- Studies, Retooling Design, Long-Leads, and Test
- Software and Cross Check Analysis
- Transition to EMD

($M)	Prior	FY92	FY93	FY94	To Complete	Total
REACT	194.7	42.0	16.1	26.15	TBD	TBD
GRP	0.0	0.0	51.0	87.40	TBD	TBD
PRP	0.0	0.0	0.0	49.94	TBD	TBD
SRV	0.0	9.0	4.0	2.00	TBD	TBD
DFMR	0.0	0.0	0.0	0.00	TBD	TBD
Total	194.7	51.0	71.1	165.49	TBD	TBD

MULTIROLE FIGHTER (MRF)

CHARACTERISTICS

- F-16 Replacement
- Air-to-Ground Primary Mission
- Air-to-Air Self Defense Capability
- Mission Areas
  - Interdiction
  - Close Air Support
  - Defensive Counter Air
  - SEAD
- Design and Selection Will Emphasize
  - Affordability
  - Reliability & Maintainability
  - Deployability
  - Survivability
  - Range/Payload

SCHEDULE

- Milestone 0 FY 94

NOTE: CSAF TESTIMONY TO HASC 1 APR 1993: "THERE IS NO MRF PROGRAM. IT IS NOT ON THE BOOKS."

MRF
RDT&E

FY94 FUNDING

- Dem/Val $4.4M

FY94 OBJECTIVES

- Prepare for Milestone 0. Timing TBD
- Continue Mission Area Assessment
  - Examine New Defense Planning Guidance Scenarios.
  - Model the Three Major Regional Conflicts with the New Def Plan. Guidance Scenarios.
  - Determine High Payoff Areas, Knee in the Curve Data Points.

$M	Prior	FY93	FY94	To Complete	Total
RDT&E	2.0	TBD	4.4	TBD	TBD

Air Force Roles

- Aerospace Control (Control the Combat Environment)
  - Counterair
  - Counterspace
- Force Application (Apply Combat Power)
  - Strategic Attack
  - Interdiction
  - Close Air Support
- Force Enhancement (Multiply Combat Effectiveness)
  - Airlift
  - Air Refueling
  - Spacelift
- Force Support (Sustain Forces)
  - Base Operability & Defense
  - Logistics
  - Combat Support

C-17 AIRLIFT PROGRAM

SECRETARY OF THE AIR FORCE ACQUISITION

CHARACTERISTICS

- Large Payload/Intercontinental Range (Outsize Cargo)
- Direct Delivery (Reduced Closure)
- High Utilization Rate
- Increased Throughput
- Small/Austere Airfields (Outsize)
- Outsize Airdrop and LAPES
- Combat Offload
- Reduced Operating Costs
- High Reliability/ Low Maintenance
- Reduced Manpower Requirements
- Enhanced Survivability

SCHEDULE

● Mission Element Need Statement	Nov 80
● Development Contract Award	Jul 82
● Milestone II (Full-Scale Dev)	Feb 85
● Milestone IIIA (LRIP)	Dec 88
● SecDef MAR Decision	Apr 90
● T-1 Assembly Complete	Dec 90
● T-1 First Flight	Sep 91
● P-1 First Flight	May 92
● Initiate Dedicated IOT&E	Feb 94*

* Based on Current Estimate of Static Failure Impact.

C-17
RDT&E

FY94 FUNDING	$180.4M
● Air Vehicle	$40.2
● System Test & Evaluation	$70.0
● Sys Eng Program Support	$20.9
● Training	$3.3
● Data	$1.0
● Simulators	$0.5
● Site Activation	$0.4
● Engineering Change Order	$44.1

FY94 OBJECTIVES

- Conduct dedicated IOT&E
- Complete all Weather Testing
- Complete one Life (30,000 hrs) of Durability Testing
- Complete Static Article Ultimate Strength Testing
- Begin Maintenance & Aircrew Training Device Deliveries to Altus AFB
- Continue Delivery of Initial Support Equipment to Altus AFB
- Begin Airlift Defensive System Integration

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	4897.3	256.8	169.8	180.4	TBD	TBD

TITAN IV

CHARACTERISTICS

- Nation's Heaviest Lift Unmanned Launch System
- Supports Warning, Communications, and National Security Payloads
- Launches from East and West Coast Facilities

SCHEDULE

● SLC-40 ILC	2Q FY93
● TIV/Centaur Initial Launch Capability (ILC)	3Q FY93
● Complete Solid Rocket Motor Unit Testing	4Q FY93

Titan IV
RDT&E

FY94 FUNDING $359.9M

● Block Change/Improvements	$34.0
● Range Safety	$91.4
● Centaur/SRMU Integration	$70.0
● Engineering Changes	$60.5
● Payload Integration	$27.3
● Facilities	$29.8
● Other Government Costs	$22.6
● Overrun	$19.6
● Titan II	$4.7

FY94 OBJECTIVES

- Launch First Titan IV/SRMU Mission
- Complete Analyses and Modifications of Centaur/SRMU
- Upgrade Flight Safety System
- Continue Milstar and DSP Integration
- Continue Titan II Engineering

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	1,829	145	130	359.9	Cont	Cont

Air Force Roles

- Aerospace Control (Control the Combat Environment)
  - Counterair
  - Counterspace
- Force Application (Apply Combat Power)
  - Strategic Attack
  - Interdiction
  - Close Air Support
- Force Enhancement (Multiply Combat Effectiveness)
  - Airlift
  - Air Refueling
  - Spacelift
- Force Support (Sustain Forces)
  - Base Operability & Defense
  - Logistics
  - Combat Support

Air Force Satellite Control Network (AFSCN)

CHARACTERISTICS

- Global Network Controlling a Growing Inventory of National Security Satellites.
- Provides Dependable Spacecraft Command and Control, Assured Telemetry Reception, and Reliable Launch and On-orbit Vehicle Tracking for GPS, DMSP, DSCS and Other DoD RDT&E and Operational Satellite Programs
- Adds Tracking Stations and Replaces Aging Telemetry, Tracking, Command and Control Equipment to Increase Capabilities and Reduce O&M Costs.
- Provides Space Test and On-orbit Support of R&D Missions.

SCHEDULE

● Automated Remote Tracking Stations (ARTS) at New Hampshire, Guam, and the Indian Ocean.	Jun 93
● Consolidated Space Operations Center Full Operational Turnover (FOT).	Sep 93
● ARTS FOT	Oct 93
● Advanced Satellite Control Prototype	Jun 94
● Integrated Satellite Control Initial Standards Development	Sep 94

AFSCN
RDT&E

FY94 FUNDING	$110.2M	FY94 OBJECTIVES
● Systems Engineering/ Integration/Test ● Consolidated Space Operations Center (CSOC) Follow-on Engineering.	$52.2M	● Provide Engineering to Meet Evolving Requirements. ● Provide Ground Systems Software Development for Satellite Block Upgrades. ● Integrate and Test all Modifications. ● Complete Residual CSOC Engineering Development Tasks.
● C³ Upgrade Projects ● Advanced Command and Control Enhancements. ● Network Communications Systems upgrades.	$58.0M	● Continue Transition of Satellite Programs to Computer Control Configuration. ● Assure Communications Network is Integrated with Mission Control Centers and Automated Remote Tracking Stations. ● Integrated Information and Engineering Support Systems.

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	1078.3	108.3	97.1	110.2	Cont	Cont

JOINT PRIMARY AIRCRAFT TRAINING SYSTEM (JPATS)

CHARACTERISTICS

- Joint Replacement Pilot Training Aircraft for AF T-37 and Navy T-34
- Supports Specialized Undergraduate Pilot Training
- 417 for AF and 347 for Navy with Associated Ground Based Training Systems
- Part of the DOD Trainer Aircraft Masterplan

SCHEDULE

● Milestone 0/1 DAB	Jan 93
● Start Source Selection	Nov 93

JPATS
RDT&E

FY94 FUNDING	$41.6M
● Air Vehicle, Missionization	$19.3
● System Test and Eval	$13.3
● Support Engineering Program Support, Support Equipment, Award Fee, Data	$9.0

FY94 OBJECTIVES

- Conduct Flight Evaluations and Source Selection
- Contract Award to Manufacture Flight Test Aircraft
- Initiate Design/ Manufacture of Test Articles
- Fund Government Test Support
- Initiate Data Development
- Initiate Support Equipment Development for Escape System

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	-	1.1	2.1	41.6	TBD	TBD

SCIENCE & TECHNOLOGY RDT&E

	FY93 Approp	FY94 Request
● National Aerospace Plane	$150M	$43M
● Research Sciences	$252	$246
● Avionics	$178	$195
● Space and Missiles	$148	$133
● Aeropropulsion	$142	$143
● Command, Control & Computational Sciences	$150	$171

	FY93 Approp	FY94 Request
● Human Systems	$141M	$114M
● Air Vehicles	$120	$106
● Conventional Armament	$67	$73
● Materials	$93	$87
● Advanced Weapons	$135	$92
● Geophysics	$49	$38
● Civil and Environmental Engineering	$23	$16

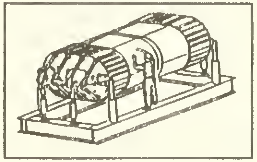
($M)	FY93 Approp	FY94 Request
S&T Total	1,650	1,457
Basic Research	252	246
Exploratory Development	651	621
Advanced Technology Development	747	590
NASP*	150	43

* Included in Advanced Technology Development Totals

Note: FY93 S&T had $73M in undistributed Congressional reductions (1,610-$73=$1,537) The total S&T request & Exploratory Development request amount does not include the amount for SBIR in FY94.

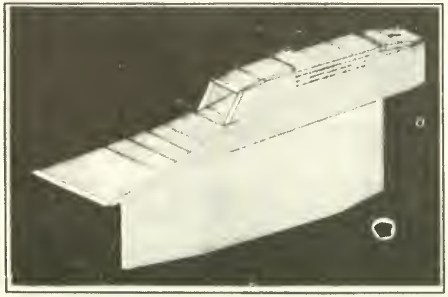
National Aero-Space Plane (NASP)

Structures/Materials
Testing and Manufacturing
Demonstrations

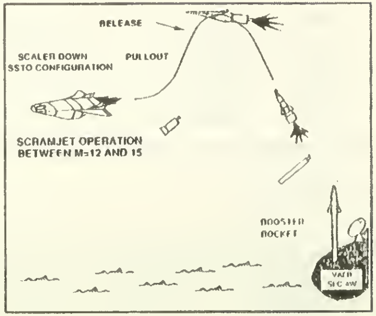


X-30 Research Vehicle

Computational
Design Tools



Ground-Based Engine Tests



Hypersonic Flight Experiments

NATIONAL AERO-SPACE PLANE (NASP)

CHARACTERISTICS

- Enabling Technologies for Future Airbreathing Single-Stage-to-Orbit and Hypersonic Cruise Vehicles
- Horizontal Takeoff and Landing from Conventional Runways
- Dual-use Civil and Military Applications, Defense Conversion and Technology Transfer
- Technical Risk Reduction Through Missile-Launched Flight Experiments and Ground-Based Technology Development

SCHEDULE

- Complete Phase 2D Activities Mar 94

NASP
RDT&E

FY94 FUNDING $43.3M

● Propulsion	$23.1
● Airframe	$15.5
● Government Work Packages	$2.5
● Applications	$0.2
● Support/GFE	$2.0

- Funding Breakout Represents Pro-rata DoD Share of Joint DoD/NASA Program. NASA FY94 Request is $80M

FY94 OBJECTIVES

- Complete Concept Demonstration Engine
- Test Actively-cooled Engine Panels at Simulated Hypersonic Heat Loads
- Conduct Engine Materials Characterization of Coupon and Panel -size Test Articles
- Preliminary Program Planning for Hypersonic Flight Experiments
- Transfer NASP Technologies to Civil and Commercial Sector

$M	Prior	FY92	FY93	FY94	To Complete	Total
RDT&E	924.5	198.1	141.2	43.3	Cont	Cont

Conclusion

- Air Force Acquisition - Equipping the World's Most Respected Air and Space Force
- Implementing the New Approach to Acquisition
- Prepared to Meet the Challenges of the Future

Biography
United States Air Force
Secretary of the Air Force, Office of Public Affairs, Washington, D.C. 20330–1000

JAMES J. MATTICE

James J. Mattice is deputy assistant secretary of the Air Force for research and engineering, Office of the Assistant Secretary of the Air Force for Acquisition, Washington, D.C. He provides technical expertise, policy and programmatic advice to the assistant secretary for acquisition on matters pertaining to research and development, systems engineering and manufacturing technology critical to Air Force weapon systems.

Mr. Mattice was born Feb. 10, 1936, in Portland, Ore., where he graduated from Central Catholic High School in 1954. He earned a bachelor's degree in chemistry from the University of Portland in 1958 and did graduate work in chemistry at Ohio State University from 1959 to 1962. He completed Stanford University's Sloan Fellowship Program in Business in 1968 and the Federal Executive Institute Executive Leadership Program in 1985.

Upon graduation from college, he was commissioned as a second lieutenant and assigned as a research chemist to the Air Force Materials Laboratory, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. He completed his military service in July 1962, and remained at the AFML as a technical area manager, supervising the overall Air Force research program for protective and thermal control coatings for aerospace vehicles.

In February 1966 Mr. Mattice was appointed chief of the Chemical Processing Branch, Manufacturing Technology Division, Aeronautical Systems Division. In July 1968 he was assigned to the laboratory director's staff, first as chief of the technical activities office and later as chief of operations. He returned to the Manufacturing Technology Division as assistant chief in July 1973 and, in April 1975, was appointed director of the Air Force Manufacturing Technology program.

Mr. Mattice was selected as deputy director of the Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, in March 1983. He was responsible for the execution of the Air Force flight vehicle research and development program. In January 1986 he was assigned as deputy director of Air Force Wright Aeronautical Laboratories, the Air Force's largest science and technology complex. He then became deputy for development planning, Aeronautical Systems Division, where he was responsible for all aspects of planning new aeronautical acquisition programs, allied and joint cooperative development and technology guidance to the Air Force Aeronautical Science and Technology Program.

In January 1990 he became special assistant to the commander, Aeronautical Systems Division, where he was responsible for the division's integration into the new Air Force Materiel Command and corporate strategic planning. He also served as senior civilian executive to the division commander. He assumed his current position in June 1992.

Mr. Mattice received the Air Force Meritorious Civilian Service Award in 1978, Air Force Systems Command Equal Employment Opportunity Achievement Award in 1978, Air Force Harold Brown Award nomination in 1980,

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and the Society of Manufacturing Engineers Distinguished Contributions Award in 1983. Also, he has received a number of special recognition awards within the Senior Executive Service, including the Meritorious Executive Presidential Rank Award in 1987.

Mr. Mattice is married to the former Darla Hizer of Rochester, Ind. They have eight children and stepchildren: Paul, Linda, Stephen, Gail, Joseph, Darrell, Kimberly and Kristin.

MILSTAR PROGRAM

Mr. Dicks. Thank you, General. I understand that MILSTAR will be part of the bottom-up review. What is the current status of the MILSTAR program, both space assets and the core terminals?

General Jaquish. MILSATCOM and MILSTAR will be a part of the bottom-up review. Those results should be available at the end of June.

I think this Committee has a dedicated space hearing in the next several weeks. Currently MILSTAR is funded along the lines of putting emphasis on the tactical terminals and getting away from the enduring nuclear conflict scenario.

We have taken some of the money out of the program in fiscal year 1994 in anticipation of further reducing the strategic requirements and focusing more on the tactical user.

I will be able to address that in more detail perhaps at the subsequent space hearing.

NATIONAL AEROSPACE PLANE (NASP) PROGRAM

Mr. Dicks. General Jaquish, in your testimony, you indicated that the Air Force is fully committed to the National Aerospace Plane (NASP). Yet, only $43.3 million is included in the fiscal year 1994 request for NASP. I find the technical questions to be very serious and wonder whether, in fact, we can afford it at this juncture.

General Jaquish. I will ask Mr. Mattice to answer that question. He is conversant on all the science and technology aspects.

Mr. Mattice. The compelling case for NASP is the fact that hypersonic technology potentially enables a pervasive set of military applications and broad commercial potential as well. That is why we have enduring interest.

The NASP program would seek to develop the technology to ultimately fly an X–30 single stage to orbit research vehicle. The program currently is under review with our other agency partner, NASA, to reexamine the nature of the technology experiments and demonstrations which we, as well as the Defense Science Board, believe need to be accomplished before trying to make what we call a phase 3 or go build the X–30 type of decision.

We are restructuring the program. We have arrived at a concept for a restructured program that, in the near term, would build subscale, sub-orbital flight vehicles to answer the two critical, technical questions; boundary layer transition and gas flow path or scram jet performance to verify the key technology is available to proceed with the NASP.

Our advisors and critics generally agree, and we understand the administration is also in agreement, with the potential for this revised program. In addition it has great dual use potential. Upon completion of getting appointed people in place, we will be reevaluating the program and seeking a consensus to go on with detailed planning and costing of the restructured program plan.

The net result should be to enable us to make an informed phase 3 decision as to whether or not it is prudent to build the X–30 as originally planned and that should give us a much lower cost option because we will have significantly reduced the risk with intervening flight experiments.

Mr. DICKS. Leading officials in the industry have advised me that the technology is not yet there to do NASP.

Mr. MATTICE. We agree that we do not have sufficient data.

Mr. DICKS. There was a gentleman who worked at the Defense Advance Research Projects Agency that strongly advocated this program for years. Was he eventually fired as a result of all of these problems?

Mr. MATTICE. I don't know what his fate was precisely, but he had a great idea which posed a tough technical problem.

Mr. DICKS. I just worry about this program because I have a great respect for this industry and the people who work in it. When they say something can't be done and they would love to do this thing, I take that pretty seriously so I would hope that you really look into the merits and capability of this program.

F-22 PROGRAM

As you know, I am very supportive of the F-22 program, but I became very concerned the other day during a briefing on the rephasing of the EMD schedule. I am concerned about the amount of time and money that it is taking to develop this airplane and to put it on the runway.

General, can you tell me why we are going to be in development on this thing through the rest of the century before we go into production? Is that correct?

General JAQUISH. Let me explain the rephasing.

We found ourselves in the situation as a result of increased overhead costs on the program and as a result of the 1993 congressional cuts to the program, and as a result of some program cost growth for those kinds of things that were underestimated at the front end of the contract.

There was a requirement to have additional funds in the early years, specifically 1994 and 1995. So we faced an alternative of either putting additional money in those years or rephasing the program.

We elected to live within the dollars available and we phased the work as a result of that.

Essentially what has happened as a result of that, is a one-year slip in the EMD phase.

Mr. DICKS. The EMD phase has now been stretched to ten years?

General JAQUISH. We have invested seed money in the engine program as early as 1983.

We recently concluded the DEM/VAL program, which was a significant effort. So depending upon how you measure, that is exactly correct. We anticipate the first flight of the EMD aircraft will be in the summer of 1996 versus the summer of 1995.

Delivery of the first production airplane moves from January of 1999 to January of 2000. But this is at no additional cost to the government, in other words, the price for EMD. It is just a matter of where you phase the money. As you know, this is a cost-plus contract so you pay the contractor for his best efforts.

We simply rephrased that work out. There is no total program cost growth at this time.

Mr. DICKS. Well, what if we wanted to move this program forward—you are saying you couldn't do it? Say Congress said, we want to accelerate this program.

General JAQUISH. It was a matter of putting more money in 1994 and 1995, which are tough years for us or rephasing the program.

We elected to rephase the program. That was a financial decision, not a technical decision.

B-2 PROGRAM

Mr. DICKS. I have been a strong supporter of the B-2 program through many, many years, and have tried to support the Air Force on it.

I have worked very hard in the House to make sure this program stayed alive. I am very concerned about the Air Force's strategy for putting smart conventional weapons on the B-2. I must tell you I find it totally unacceptable that the current Air Force strategy indicates that we will not have smart weapons on the B-2 until 1999. I am told it won't happen until 1999 because the Air Force is worried about its JDAM program.

I believe the B-2 is a crucial national security asset. I think we should be giving this aircraft the kind of capability that it can have, smart weapons capability as quickly as possible, and I think I can convince my colleagues on the Committee that whatever investment is needed to it, we ought to do it.

I don't understand why the Air Force is bucking this thing and saying we are not going to do it. If we had B-2 with smart conventional weapons, we might have been able to take out that invading division coming from Iraq into Kuwait and may have been able to stop the entire event from happening.

The Rand people have done an impressive study of what the B-2 can do with smart conventional weapons. I think it is a revolutionary conventional capability. The idea that we are now going to hold this thing up because of some other Air Force program, I don't buy that.

I have taken this to General McPeak and General Loh. General Loh feels we are right on this. I am going to have a hard time explaining to my colleagues on the Floor, whom I asked to support this program, why we are not going to get some smart weapon capability on the B-2 before 1999.

General JAQUISH. The Air Force agrees with you a thousand percent. Had we had the B-2 in Desert Storm as the Iraquis were moving south, we could have flown from the CONUS.

GATS/GAM ON B-2

You are correct at this point in time, it will be 1999 before we have a precision-guided weapon on the B-2. However, we are currently evaluating another proposal, in fact, it is a proposal from Northrop to produce near-precision capability on the B-2 some 2½ to 3 years earlier than that. That is under evaluation. I don't know where you not the notion that we were stonewalling it.

Mr. DICKS. My spies tell me and I have pretty good spies. I am on the Intelligence Committee. They tell me that General McPeak and others are so wedded to the Joint Direct Attack Munition program (JDAM). I am not sure where you are on saying no to the Northrop proposals. We can't move it up because it could undermine the JDAM program.

What if we guarantee we will keep JDAM alive, but we want the Air Force to move ahead——

General JAQUISH. There was concern expressed of linking this capability and using that as a reason not to do JDAM. JDAM is core to our conventional weapon strategy for the B-2, the B-1, and our fighters.

We are convinced that the two can be separated on a business perspective and would sell that as a package. We would need your support to be able to do the proposal that the B-2 contractor laid on and at the same time not interfere with JDAM.

I am taking a presentation to the Chief in the next ten days to lay out exactly that kind of acquisition strategy.

Mr. DICKS. I am very glad to hear that this program is being considered.

General JAQUISH. There is a DELTA cost here. There is some cost and we will have to look at that cost, but at least in our minds, I am convinced that from a business perspective, we can keep the two apart.

If we can reach some sort of understanding with Congress that these are not competing weapons between early PGM capability and the long-term application of JDAM for all airplanes.

Mr. DICKS. I think it makes sense to do this, and I will support you in that. I am told that Northrop has indicated they are willing to not compete in JDAM. I am also told there is a new wrinkle here. These are my same spies. The new wrinkle is that you want to compete GATS/GAM instead of doing what Northrop has suggested you to do with this system. Such a competition would take years, wouldn't it?

General JAQUISH. One of the checklist items is before you do anything sole source, you have to go through the rules of competition. There has been discussion about—Would we have to compete that?—That answer is due to me in the next five or six days before I go to the Chief.

Unless we are required by law to compete and if there is satisfactory justification to go to Northrop to do it and if the government is willing to invest the money, I think there will be a good match there. In a lot of circles, there has been this notion that we have been stonewalling this, not evaluating it, et cetera, and that is not correct. The PEOs for JDAM and the B-2 are involved in this. My contract people are involved in this.

NUMBER OF B-2 AIRCRAFT

Mr. DICKS. There is no doubt that the B-2 should be used as a conventional weapon carrier?

General JAQUISH. That is why we feel so strongly that the last five airplanes in finishing out the support equipment is vital. The difference between 16 airplanes and 20 airplanes is significant in terms of capability to go both ways to perhaps two conflicts, but also to deploy forward and work that.

Mr. DICKS. The Rand study that Mr. Aspin commissioned suggested that the right number here is not 20 airplanes. It was somewhere between 40 and 60 in order to have a robust conventional capability and think ahead about the cost of building a follow-on bomber at some juncture. How do you feel about that perfect world?

General JAQUISH. We were on the road to 132, which got cut to 75 during the major aircraft review. When the number came out 20, we were obliged to support the President's decision, but if we were to have more B–2s, 40 or 50, we would have unprecedented capability with that airplane.

Individually they can go halfway around the world unrefueled from the CONUS and attack very heavily defended targets. They will carry upwards to 16 precision-guided weapons. Without escort and everything else launched from CONUS, that is a tremendous capability.

[CLERK'S NOTE.—In editing the testimony, the Air Force clarified their statement to read: "Individually they can go nearly a quarter of the way around the world * * *".]

CONVENTIONAL CAPABILITY OF THE B–2

Mr. DICKS. One of the problems I think we have is that many of our colleagues still think of the B–2 as another nuclear bomb dropper, and they think it is redundant and expensive.

I don't think people have fully realized the conventional capability. It is unprecedented. We were arguing about what kind of bomb-dropping capability we are going to get on aircraft carriers that will go out 400 or 500 miles.

The B–2 could go a third of the way around the world with one aerial refueling.

If you look at how successful the F–117 was in the desert with two 2,000-pound bombs, you said 16 in the B–2, and the ability, according to the Rand study, the study indicated that more than 40 percent of the vehicles in that division of mechanized vehicles were destroyed, which is more than enough to halt an armored division's advance. That is using sensor-fused weapons, that scenario; 40 percent of the weapons were destroyed, or taken out of action.

They said they have done these scenarios against a division before and never been able to slow it down using all other capabilities and yet the B–2, with smart weapons stopped this Iraqi division.

I feel that we need to move on something that provides such a potential capability. It strengthens the case for those of us who want to raise the question "do we want to end this program?" There is still uncertainty in the world, we have a stealthy platform with enormous capabilities.

General JAQUISH. Affordability of additional B–2s is going to be significant.

Mr. DICKS. At an earlier meeting, it has been suggested that if we stood down some of the B–1s and B–52s, enough money would be created to keep the B–2 program going forward. Their position was that since the B-2 is so much more capable and effective, that this was an option that might be considered if you really had to get down to it.

General JAQUISH. One could look at it that you would trade B-52s off, trade off some number——

Mr. DICKS. In order to be able to afford additional B-2s?

General JAQUISH. Given you have already paid for the B-52s, it would take a lot of B-52s, sir.

Mr. DICKS. Mr. McDade.

F-22 TOOLING

Mr. McDADE. With regard to the F-22, the first flight for the F-22 is scheduled for June 1996. Is that still the correct date?

General JAQUISH. Yes, sir.

Mr. DICKS. Major decisions on tooling for EMD aircraft are being funded in fiscal years 1994 and 1995. The bulk of the money for tooling, about $500 million of the $700 million, is coming in those two fiscal years. Why was the decision made to go with hard tooling against soft tooling for EMD aircraft?

General JAQUISH. From lessons learned when we focused on full-scale engineering development and not the manufacturing aspects of the airplanes, we found ourselves in the position that we had built a lot of handwork, craftsman kind of airplanes during flight tests and when we transitioned to production, we didn't know how to build the airplane.

For that reason, the department adopted a cost-plus strategy with regard to contracting and decided that we would do an engineering and manufacturing development during this phase.

So we are forced to do the planning and the development associated with the production phase during this phase. So that is why——

Mr. McDADE. The flip side of that, which is the Committee's concern, is that there is so much testing to be done and it will be so long before you reach final decisions on the airplane, isn't it premature to be making a decision on hard tooling at this time in the process?

General JAQUISH. I don't think you could do the testing you need to do on the F-22 without going to hard tooling. One of the problems with soft tooling is that it is not as precise. It is a craftsman kind of approach, not as precise and not as repeatable.

The F-22 achieves its stealth through its shape and the way the different pieces fit together so hard tooling is the way you achieve that shape and repeatability so that you can do it.

I understand the concern of the committee. But when you look at soft versus hard tooling, while hard tooling costs you more money up front across the life of the program there is not a significant difference between hard and soft tooling. If you then look at the life cycle costs associated with soft tooling, for example, the first 25 F-117s were built with soft tooling. In order to put on a new gear or door, it has to be hand manufactured because there is no common piece. So they are tailored in that way.

The Defense Science Board looked at this and has commended us for going to hard tooling. MIT, which is leading the studies, has looked at this and commended us for going to hard tooling. It does require a little more money up front, but it pays off and it is the only way you can do the F-22.

[CLERK'S NOTE.—Subsequent to the hearing, the Committee requested the appropriate excerpts from the Defense Science Board and MIT studies commending the Air Force for going to hard tooling. The following is the Air Force response:]

The testimony statement did not cite studies. The positive comments to the Air Force came from personal discussions between Air Force acquisition officials and individuals associated with the MIT lean aircraft production study. During these discussions, MIT officials (some of whom are also members of the DSB) told the Air Force that F-22 program plans for going to hard tooling were a very good idea. In light of modern manufacturing procedures, and especially in light of the extremely tight tolerances required by the aircraft, hard tooling is preferable to soft tooling approaches. Similarly, in discussions with DSB members working on the Technical Risk Assessment of the F-22, as part of the Congressionally mandated reports submitted in April, 1993, there were endorsements of F-22 tooling approaches.

General JAQUISH. Not only that, the tooling that will build the 9 EMD test airplanes is the same tooling that would build the first production airplanes. That tooling once procured will equate to about 10 airplanes a year versus production.

So even if you went from that capability to do 10 a year to 48 a year, which is the current program and probably higher than we will end up, it does not cost a lot more money to get there.

It is $160 million to go from what you have spent developing that tooling during EMD and achieving 48 a year.

Mr. MCDADE. Does that seem like it is at risk if you had to change the design somewhere along the line?

General JAQUISH. The design is a very, very mature design.

Mr. MCDADE. This airplane is a long way off. You still have to do first flight, testing, before full-scale development. It will be a long time before you get to production and we have seen a lot of unanticipated things happen. Are you addressing it in terms of talking about the essentiality of actually conducting the test? You couldn't do it without hard tooling.

General JAQUISH. You cannot build the F-22 using soft tooling. In the F-117 case, they don't rely so much on shape. They put on applique.

The F-22 achieves stealth through shape so that shape must be perfect, very repeatable and how different sections come together has to be exactly the same because you will lose control of the shape otherwise and not have the stealth.

So I understand the concern, but anybody that I know of who is an expert in this matter has in fact commended us for going to hard tooling and facing up to it now.

Mr. MCDADE. Thank you, General, Thank you, Mr. Chairman.

Mr. DICKS. Mr. Darden?

F-22 RESTRUCTURE

Mr. DARDEN. Thank you very much.

General, I am somewhat at a disadvantage that unlike the Chairman I don't have any spies, but I do have a few concerns I would like to follow up on regarding some of the points he made and made, I think, very clearly to you, with reference to the slippage of the F-22 program.

Now, we as Committee members have heard quite a bit about the congressional cuts that were made in the program last year, but as I recall, they came only to just over $200 million. It is my further recollection that the overhead by the contractors increases were about $526 million, and the program increases in costs were about another $350 million, so the $216 or so million dollars that was taken out of the program was not the primary contributor to the cost overruns, was it?

General **Jaquish**. Well, you are exactly correct with regard to the program cost growth. It was $350 million. The congressional cut was $285 million.

While the overhead growth was in fact $529 million most all of that was absorbed within the companies, so there was a cost to the government of $129 million total for overhead.

With all of those things, we then faced the situation where we needed close to a billion dollars in the 1994–1995 time frame and decided that we would live within the total program costs and defer the work. That is the nature of a cost-plus contract.

Mr. **Darden**. But any allegation by the contractor or the members of the team that the sole factor which pushes this further out to the right is the inability of the Congress or the lack of funding is not entirely correct.

General **Jaquish**. That is correct.

I would also hasten to add that as you know we are at a very critical time in this program. We have finished the preliminary design review. This is the time not to perturbate the funding.

There were three reasons for that stretch-out and the congressional cut was just one of those three.

Mr. **Darden**. We hear about the cuts, but the cuts followed these other two items.

General **Jaquish**. There was one other aspect of this. The Air Force had put a significant amount of money, risk money, into this program, management reserve, et cetera. Unfortunately, when that money was loaded in the program, it was in the 1997–98 time frame and there was inadequate risk money upfront.

Had that money been in the 1994–95 time frame, we would have been able to offset this that way. That also contributed to it.

Mr. **Darden**. As elected officials, we don't mind taking what raps we are due, but I did want the record clear that there was a lot more to it than just this one funding reduction that occurred and that was not the sole contributing factor to it being moved to the right as we had seen.

RUSSIAN NEXT-GENERATION FIGHTERS

Last year Defense Weekly reported that Russia had flown a next-generation fighter aircraft referred to as an air superiority fighter. Can you verify this report or expand on any such advance threat?

General **Jaquish**. The information I have is that the Russians flew what has become known as an SU–35. It is kind of a follow-on to the SU–27. It is not what we thought previously they were working on. This airplane has some stealth applique, probably has aerodynamic performance better than the F–15, has an advanced radar, perhaps an electrically scanned antenna and digital flight controls.

In addition, we have other information, ——— that there is significant work going on on a follow-on multi-role fighter interceptor. I think that airplane is more along the lines of what we had previously assumed and labeled the ASF and CAF.

——— Estimates are that that airplane could achieve IOC in the 2008 time frame. That airplane is looking at our ATF and trying to get into that league. They will not get into that league from a stealth perspective, but I am sure this will be a very capable aircraft.

PEACEKEEPER MISSILE

Mr. DARDEN. In view of the START I, START II treaties, I realize from the discussions between our President and President Yeltsin and others that our situation has dramatically changed with reference to our missile land deterrent, and we know that the Peacekeeper program has been terminated.

What about flight test missiles for that program? Are there funds in the budget for flight tests of the Peacekeeper or are we gradually dismantling it and there will be no more testing.

General JAQUISH. Peacekeepers are starting in the drawdown phase. Like we had, during that period of time we will continue to do tests of the Peacekeeper as long as it is on alert.

[CLERK'S NOTE. Subsequent to the hearing, the Air Force provided the following additional information:]

The Peacekeeper will remain on alert right up to the beginning of its scheduled drawdown. Assuming ratification of START II, Peacekeeper drawdown will begin in the year 2000 and should be complete by 1 January 2003. Peacekeeper flight testing will continue through the mid-1990's to ensure its readiness as a viable deterrent.

Mr. DARDEN. So we will continue to flight test it as long as it is on alert?

General JAQUISH. No, only through the mid 1990s. Once it goes off alert like we have done with previous strategic missiles, Minuteman II's specifically, we convert them and use them for launching other R&D projects.

We would look at Peacekeeper to do that. One of the risk reduction efforts on the NASP, in fact, conceptually would use a Peacekeeper set of boosters to do that risk reduction.

So we would continue to use those assets in those kinds of ways.

ROLE OF THE B–1B BOMBER

Mr. DARDEN. The Chairman mentioned the B–1B and I think we have all been somewhat frustrated over the fact that it has experienced these substantial delays and we have what, 95 aircraft——

General JAQUISH. There are 95 aircraft, yes; sir.

Mr. DARDEN. Where do we stand as far as a fix to the B–1B is concerned? Is this your issue or is that a procurement issue?

General JAQUISH. This is a good time to talk about that, sir. The B–1 is in a situation where it is a superb airplane. I have personally flown it. The guys that fly it love it. The problem is it is now converting from a nuclear to a conventional role. We have funded as a part of this budget consistent with the bomber roadmap which looked at the B–2, B–1, and B–52H's the conventionalization of the B–1.

That is along the lines that the chairman spoke of trying to get precision weapons capability on to the B-1 and converting it.

In addition to that, we must convert its ECM system from that of a nuclear-penetrating bomber to that of a conventional bomber and it puts different stresses on your ECM system.

As a SIOP penetration, you would have already had a laydown, and you would have an airplane in that environment. In a conventional role, you have to go back into the threats.

B-1 ECM SYSTEM

Mr. Darden. When we fix the ECM system, then we need another one?

General Jaquish. One that works. In fact, we were never able to complete the original ECM system on the B-1. It is a matter that the kind of ECM systems you need in a conventional environment are different than the kind of ECM protection you would need in a nuclear SIOP role.

So the Air Force has funds to do risk-reduction studies to articulate those requirements, do trade-off studies to understand that and from that then we will ask the contractor who will be Rockwell, the integrating contractor for the conventional and ECM upgrade to pull together those risk reduction studies and head for a DAB in 1994.

So we have funded, starting this year, a total of $2.5 billion R&D and procurement to upgrade the airplane conventionally and its ECM.

Mr. Darden. Is that included in this year's budget or are funds already appropriated?

General Jaquish. No.

In 1994, we have a request for the conventionalization of the B-1 for $86.3 million and $7 million for ECM. That is to do work on anti-jam radios, put GPS in it, update its computer, bring 1760 bus capability on the airplane and there is $7 million there for risk reduction studies on the ECM half.

Mr. Darden. Thank you.

Mr. Dicks. Mr. Young?

EXCIMER LASER

Mr. Young. Thank you.

For the Excimer Laser, we have appropriated $50 million. What does the Excimer Laser do for the Air Force?

Mr. Mattice. That is an experiment in technology to be able to image objects in space. It has a broad array of interest, both military and commercial.

We have tried to take that direction and implement the program that the Congress desires. You are probably getting at what was understood to be a potential sourcing of that program for Somalia operations funding needs.

As of this morning, DOD advised us that the Excimer project is no longer a source for the Somali requirement. We need to do nothing because we had not taken action to stop or slow down work.

We were about a week away. We are now in good shape so I think we will execute the program.

Mr. **Young**. So the Somali reprogramming is gone. You had proposed stopping the research in the third year, but you are going to continue the research.

Mr. **Mattice**. We see it as a value-added program for space object identification. We plan to execute the research in accordance with the funding you provide.

Mr. **Young**. Is it workable?

Mr. **Mattice**. It is very early in the program, but conceptually it seems to be well based. Like many laser applications particularly at long ranges through the environment, it remains to be seen whether or not it is practical from an engineering point of view.

We take the approach of working out the fundamental and scientific variables to prove feasibility before we demonstrate.

Mr. **Young**. Could it be used from a satellite or from a shuttle?

Mr. **Mattice**. There is no reason from a scientific basis why you could not. We would be outside of the atmosphere and that aspect of the problem would be simpler.

Mr. **Young**. You are going to continue to work the program?

Mr. **Mattice**. We plan to continue the work in accordance with the funding, yes.

Mr. **Dicks**. Mr. Visclosky?

C–17 PROGRAM

Mr. **Visclosky**. Thank you, Mr. Chairman.

General, thank you very much for your time today. I have a number of questions on the C–17 program.

CARGO AIRCRAFT LOADS

Before I start, one of the things I want to ask about the R&D program is just other areas that the Air Force may be working on in terms of developing equipment, if you would, once planes take materials to a specific location to increase and expedite your throughput both in loading these crafts and unloading them.

The size and configuration of the pallets, for example, in terms of the C–141 and the C–17 and the C–130 and the C–5 and the KC–10, all of the pictures I have seen and some of the terminology I have heard is that you will cube out before you will hit your maximum weight of the plane.

My understanding of commercial aircraft is that, for those which move cargo, there is not necessarily a box configuration on all the pallets and curvature must be taken into consideration.

Has the Air Force used this type of pallet? Are they examining its use to provide more cubes before they max out on the weight?

General **Jaquish**. I think we have, but I need to check the answer out. I would imagine that the true answer would be that our palletization cargo for the C–17, like the C–141, is designed for roll on/roll off and ease of handling.

So when you get inside the cavity and the doors are closed and you look left and right of the pallet or on top of the pallet and see there is another foot of space you think maybe you could do that, but it is constrained by door size.

I will provide a better answer for the record.

I believe you are constrained to getting it into the airplane and it is designed for quick loading on and off.

[The information follows:]

The Air Force is pursuing several initiatives to increase throughput at the aerial ports. These initiatives include the procurement of the 60K loader, palletized cargo policy directives, and modernization and mechanization of port facilities. The 60K loader permits efficient handling of jumbo aircraft (KC-10, DC-10, 747, etc.). The current wide body loader takes considerable time to set up and reposition, and can handle a very limited number of pallets at any one time. The 60K loader, which is currently in operational test, will greatly improve cargo handling performance. Secondly, HQ AMC has directed all aerial ports to increase the weight of palletized cargo. Finally, port facility modernization and mechanization is directed at automating the process of handling cargo. This automation will speed moving the pallets from storage onto the loader headed to the aircraft and directing incoming cargo to appropriate channels.

The Air Force uses contoured pallets in appropriate circumstances. The process of building pallets is very labor intensive. At the aerial ports, the pallets are built using a template based on the configuration of the transporting aircraft. For military aircraft, this template is generally a box the size of the pallet and 96 inches high. The templates used for commercial aircraft dictate their shape with some being curved and others having box shapes. For example, the Boeing 767 carries 26 contoured pallets on its upper deck and 7 box shaped pallets restricted to 60 inches high on the lower deck.

Regardless of the shape, all military palletized cargo is shipped on a standard 463L pallet. This pallet is much sturdier and more durable than the commercial cargo pallet. It also has the advantage of being distributed worldwide at every military installation. Commercial aircraft can handle the 463L pallet without any problem.

Commercial aircraft, like military aircraft, fill up, or cube out, before reaching maximum gross weight. This is a function of cargo density. The Air Force has examined the use of commercial pallets and finds that they do not meet the requirement.

Mr. VISCLOSKY. In terms of the airlift for Desert Shield and Desert Storm and potentially other types of operations, have you used commercial cargo craft?

General JAQUISH. Yes, sir. In fact, we used significant CRAF during Desert Shield and Desert Storm and I believe we have used cargo airplanes and are continuing to look at cargo airplanes. We used to have dedicated Air Force airplanes for logistics support where we would move key parts and supplies from the flight lines to the depots to get work.

We are now doing that by contract. We have gone totally commercial in that regard. There are several proposals to look at an application of a 767 and that sort of thing.

There is a lot of that cargo that can be carried by those types of airplanes. There are certain other loads that you just can't carry on those airplanes.

Mr. VISCLOSKY. If you could answer for the record on the pallets, as long as you have real life experience using commercial cargo aircraft and at least one of the options under consideration is use of commercial-type cargo aircraft, I would be interested in whether we can increase our load and deal with the cubes.

My understanding, and I am still pretty much at ground zero here, is that in every category the more you get on the airplane and get it out of there, the better off you are.

General JAQUISH. I will give you that.

[The information follows:]

You are correct: The more you can move on each aircraft the better off you are; you will have to make fewer trips. There are two basic aircraft limits: weight and cube. Our pallet and net system helps to consolidate cargo, restrain it in the aircraft and make loading the aircraft faster. But, pallets don't have a major effect on either the cube or weight restrictions within the aircraft. Most aircraft will "cube out" before they "weight out." This is because the bulk to weight ratio of a lot of military cargo (rations and light trucks, for example) is very high. Other commodities that are dense (munitions and main battle tanks for example) will exceed the weight limitation of the aircraft well before we are able to fill all of the available space.

General **Jaquish**. With regard to your statement about cubing out rather than weighting out, that was exactly the case when JCS looked at moving some great number of tons of Army cargo. As you cubed it out and the average load on the airplane was 90,000 to 100,000 pounds rather than upwards to 160,000-pound load limit.

Only in one case—and I think that was less than 1 percent of the time—did we even get up to 127,000 pounds. There may be efficiencies there that I am not aware of.

I will get a detailed answer for the record.

[The information follows:]

Cargo density greatly affects the total amount of payload carried by our airlifters. A representative pallet of spares and test equipment for a fighter wing deployment generally weighs about 4,000 pounds. An Army ground unit's rations and fortification materials weigh about 5,500 pounds. Thus, you typically reach maximum cube before reaching maximum payload. Only in limited cases do we achieve maximum payload prior to maximum cube—the transportation of ammunition. A pallet of ammunition can weigh up to 9,000 pounds.

The Congressionally directed Mobility Requirements Study (MRS) analyzed many scenarios. These scenarios demonstrated that, for Army unit moves, a large portion of the loads are not palletized cargo, but oversized or outsized equipment and vehicles. These loads, like most pallet loads, have a low cargo density resulting likewise in aircraft achieving maximum cube prior to reaching maximum payload.

AMC cargo shipping experience shows that, due to low cargo density, both commercial and military aircraft generally cube out prior to reaching maximum payload. As an example, the high mobility, multi-purpose wheeled vehicle (HMMWV), or Hum Vee, a common air transportable load occupies two pallet positions but weighs only 5,500 pounds empty or 7,650 pounds when fully loaded with the soldier's gear. Six HMMWVs would fill a C–141 transport at a weight of 46,000 pounds against a maximum cabin load of 89,000 pounds. Likewise, the C–5 with a maximum payload of 291,000 pounds, generally cubes out at between 140,000 and 170,000 pounds total weight. The Boeing 747–400, a commercial equivalent aircraft, has a maximum payload of 243,000 pounds, yet typically carries a payload of between 120,000 and 160,000 pounds.

CARGO PLATFORM LOADERS

Mr. **Visclosky**. In terms of efficiencies of loading and unloading, is the Air Force testing new flatbed trucks to pull up to the aircraft and have pallets driven or pulled on to the tractor trailers and pulled away?

General **Jaquish**. We utilize universal platform loaders to roll cargo on and off plus we are developing a 60,000 pound loader not specifically for the C–17. It was developed to support both military and civil aircraft.

One advantage if you go to a commercial freight approach for the cargo, at main operating bases throughout the world, that support equipment is already in place. No matter what major airport you land at, they would have the capability to load 767s, 747s, those kinds of airplanes.

Mr. **Visclosky**. In terms of your development of the 60(K) loader——

Mr. **Mattice**. It is kind of a complex Tinker Toy device where you have to lift the load and insert/unload it in the commercial airplane design, which is a challenge versus military cargo airplanes.

Mr. VISCLOSKY. This would not necessarily be developed to have cargo driven off the ramp of the military aircraft?

Mr. MATTICE. No. That is a problem facilitated by the fact that we generally rear loading and lower cargo floors.

Mr. VISCLOSKY. Are you using a 25(K) loader for military aircraft?

Mr. MATTICE. Yes. These are the C–130, C–141, C–5, and KC–135 cargo versions. For the KC–10 where you have to lift it up before you can put it in, we are developing a 60(K).

Mr. VISCLOSKY. That would also then be for the KC–135 and KC–10?

Mr. MATTICE. The 25(K) is adequate for the current KC–135 707 variants. There was a loader designed and delivered with the KC–10, but it proved to lack durability in the field so we undertook a new design. Prototypes have been produced and I believe they are getting ready to go out on competitive procurement for the fleet.

I believe it would be used primarily for the KC–10.

General JAQUISH. We will get a detailed response back to you.

[The information follows:]

The Air Force uses the 25(K) loader to load/off-load up to three aircraft pallets on KC–135, C–130, C–141, C–5 (in the kneeling position) and C–17 aircraft. This loader is air transportable on C–130, C–141, C–5, and C–17 aircraft (not air transportable on commercial). The loader cannot reach the main cargo deck of wide bodied aircraft. Additionally, the 25(K) tactical loader is similar to the 25(K) just described but also provides off-road capability.

Yes, the Air Force will use the 60(K) to provide an enhanced loading/off-loading capability for all military and commercial aircraft. This will include the KC–135 and KC–10. The 60(K) will move up to six pallets at a time. The 60(K) will reach all heights up to 18.5 feet, enabling it to load/off-load all wide bodied aircraft.

Mr. VISCLOSKY. The 25(K) and the 40(K), and the 60(K) is prototyped—would not be anticipated for use with the C–130, C–141——

Mr. MATTICE. The C–130 and C–141 use the 25K to roll on/off palletized cargo. However, you don't have to lift them out.

Mr. VISCLOSKY. You have proposals for the 747 and 767. You indicate, General, that that type of equipment is standardized and configured throughout the world. One briefing I had indicated to me that the equipment, the loader, cannot be loaded on to a 767 or 747; is that correct information that I have been given or not?

General JAQUISH. I have the same opinion, but I will have to get you the answer. I think the loader itself does not fit on the airplane.

[The information follows:]

The information is correct—the loaders cannot be loaded on to a 767 or 747. The 25(K) loader is air transportable on the C–103, C–141, C–5, and C–17 aircraft (not transportable on commercial aircraft). The 60(K) loader is air transportable on the C–141, C–5, and C–17 aircraft (not transportable on commercial aircraft).

Mr. VISCLOSKY. I am not saying that is my opinion. In a briefing, I have been told that the loader for the 767 and 747 cannot be loaded on to those planes to be taken with them if necessary despite the other contention that the equipment is available around the world.

General JAQUISH. I don't know the answer. I believe that that is correct. That you cannot take it with you, but certainly if you needed that loader in someplace where there is not a loader, you could use some other means of lifting it in there.

Mr. VISCLOSKY. Can you take the 25(K) loader on the KC-135 and KC-10?

Answer that for the record.

[The information follows:]

No, both the KC-135 and KC-10 have small, side cargo doors which cannot accommodate long items. The 25(K) loader can be moved on the C-130, C-141 and C-5. The 40(K) loader can be moved on the C-141 and C-5.

FIGHTER ROADMAP

Mr. DICKS. You established the bomber roadmap. Are you going to establish a fighter roadmap?

General JAQUISH. Sir, we have a fighter roadmap It is in the Pentagon and it is called the Air Power Master plan. It has, in fact, kept current with force structure decisions and that sort of thing so it is available.

Mr. DICKS. CBO has suggested 18 tactical wings. What do you think of that?

General JAQUISH. Well, I think the current budget took us down to 24.3 tactical fighter wings. Not too many years ago we were looking at how we were going to build to 44, 46 tactical fighter wings.

I don't know where the bottom is, but in my opinion, I think 24 is getting dangerously low in terms of tactical airplanes and 18 is a very, very low number.

F-22 ALTERNATIVES

Mr. DICKS. The Air Force's fiscal year 1994 R&D budget envisions the F-22 as the keystone to its investment strategy of the future, with some enhancements to the F-16 and F-15E aircraft. On only Air Force fighter programs, there have been other proposals made to upgrade the F-117 and F-16, with additional production of F-16 and F-15 aircraft as ways to solve the fighter problem if the F-22 program is delayed or cancelled for any reason.

General Jaquish are you aware of these ideas that are out there mainly I think promoted by the contractors?

General JAQUISH. Yes, sir.

Mr. DICKS. What is the Air Force evaluation of these proposals?

General JAQUISH. Starting in 1990 when then-Secretary of Defense Cheney had a Major Aircraft Review, we looked at the maximum one could do to the F-15 and F-16 to accomplish the ATF mission and they couldn't do it and it saved no money in the attempt.

We have never looked at the F-117 in the application of air-to-air although for every other mission, there has been some variants of the F-117 out there. No matter what you do with those airplanes, you will never achieve the level of stealth and superiority that the F-22 offers you.

FIGHTER INDUSTRIAL BASE

Mr. DICKS. Do you believe the domestic industrial base should be a major consideration in future decisions on tactical fighter programs of the Air Force?

General JAQUISH. Industrial base has to be a part of those decisions. I think you have seen that in the recent decision with regard to continued production of the F-16. That was basically an industrial base decision on the Department of Defense behalf.

BOTTOM-UP REVIEW OF FIGHTER AIRCRAFT

Mr. DICKS. A Defense News article indicated that the Office of the Secretary of Defense is considering the merger of the F-22 and A/F-X programs. General Jaquish, are you aware of this review?

General JAQUISH. There is a bottom-up review going on, as we spoke to earlier. I have not heard of any merger between the F-22 and the A/F-X. The technology being developed for the ATF will flow down to all fighter airplanes, specifically to the A/F-X—the composite, stealth, integrated avionics technologies will flow down, but in terms of merging them together, no, sir.

F-22 INTEGRATED AVIONICS AND SOFTWARE

Mr. DICKS. In addition to cost uncertainties, technical hurdles and economic factors that all programs currently face, the Defense Science Board—DSB—report stated that the highest technical risk in the F-22 program is the integrated avionics and its associated integration software.

The DSB report also stated that other risk areas include low-observable materials and structures, engine durability, and weight and drag management. Do you think these are problems that you can handle?

General JAQUISH. First off, I think the Defense Science Board is correct. The largest challenge that we have in this program is the integrated avionics, but during DEM/VAL, we spent a lot of money developing the architecture. In fact, the specific ADA language to do the software and a lot of the lines of code written in DEM/VAL will roll over and apply to production.

They also said they had identified all the technical risks and had the scheme and process in place to address those. They gave us very strong support in that regard.

Mr. MATTICE. We specifically have built into the program a flying avionics test bed to give us the technical results well before the actual integration occurs in the airplane.

Mr. DICKS. I assume Boeing will have experience on that.

General JAQUISH. Yes, sir.

F-22 WEIGHT

Mr. DICKS. Weight of the airplane, is that a problem?

General JAQUISH. We are always challenged by weight in airplanes. We don't chase weight to just chase weight, we do it because that is a key ingredient in terms of achieving performance parameters.

Weight control in this program, I think, has been better than any in the past. We are continuing to work this off. I think the prime contractor has done a great job breaking out the weight. For each element, there are weight design goals and all the subcontractors and everybody is working on weight reduction.

F-22 FUNDING

Mr. DICKS. Is the F-22 procurement program underfunded?

General JAQUISH. No, sir.

Mr. DICKS. There are some suggestions that the money for Lockheed increased by $22 million and people say one of the problems with the C-17 is we never properly funded it.

General JAQUISH. We ended up putting $1.1 billion more on the contract. That money was taken from management reserve risk money that we had in the program. So the airplane is fully funded to this point. I would add as a result of a recent decision on inflation rates we have taken an inflation cut across the board in all programs that is probably not consistent with what is going on in the outside world.

We will have to come back in our 1995 and 1996 budget and put more money in on everything we have got; B-2, F-22, the whole nine yards.

Mr. DICKS. Mr. Visclosky?

FLAT BED LOADERS FOR CARGO AIRCRAFT

Mr. VISCLOSKY. Thank you.

General, to back up for a second, for what craft would the flat bed loaders be designed for and anticipated to be used?

General JAQUISH. I will take all of those questions for the record and provide quality answers.

[The information follows:]

The 60(K) loader is designed to be used for all military and civilian aircraft. This capability is based primarily upon its ability to elevate loads to a height of 18.5 feet.

C-17 FLIGHT TEST PROGRAM

Mr. VISCLOSKY. I would like to cover three issues on the C-17.

First is the question of cost for the flight test program. The 1994 RDT&E request for the C-17 program is $179.8 million, which is double the estimate to complete the program that was given last year. Those are fiscal year 1994 dollars. Has the Air Force worked up a figure for fiscal year 1995?

General JAQUISH. Yes.

The added money that you are speaking to, you are correct, is associated with the flight test extension, and does take—last year we thought 1994 was going to be $93 million. This year it is $180 million. I anticipate that we have roughly $120 million to $130 million to go beyond that.

Last year we thought we would have about $100 million to go. This year I am telling you we have $300 million to go.

[CLERK'S NOTE.—Subsequent to the hearing, the Air Force provided the following additional information:]

You are correct, we experienced approximately a $87 million increase in RDT&E for FY 94. Approximately 40% is attributed to the flight test program. Approximately 20% is attributed to Live Fire tests and 14% of the increase was a transfer of work and funds for airlift defensive systems to the C–17 program element.

Mr. VISCLOSKY. Could you explain some of the problems and causes for that significant increase in the flight test program?

General JAQUISH. Frankly from the onset, we had an unexecutable flight test program. It was overly ambitious. We had late deliveries, rework on the airplanes after they were delivered, and in addition to that, on the individual sorties as they were flown in the flight test program, we were unable to achieve the efficiency rates in terms of test accomplishments that were forecast.

As a result of that, we made the decision to extend that flight test program 44 months. Now that program will be completed in January 1995 and the contractor bears a large burden of that cost. The government has to support that flight test and this increase is in support of that flight test.

C–17 LIVE FIRE TESTING

Mr. VISCLOSKY. How much is live fire testing in terms of time and cost? What is the status of the live fire testing program?

General JAQUISH. According to Section 2366 of the U.S. Code, it requires that for all new weapon systems, we do realistic testing. Last year the authorization act identified the C–17 as a covered system. In other words, one that you had to do. There are two options here. You can either take a full-up C–17 out and shoot it with a threat type of system or you can taken components out. Now in order to do it with components, we have to come back to you and we are working on that with OSD now, and come back for Congressional approval to allow us to do component testing rather than blowing a single full-up C–17 up.

To do the full-up live fire test upon a C–17 is a significant amount of money. Even if we do the component testing we will need $18 million in 1994, $18 million in 1995, and probably $4 million in 1996 to do that. That was included in our R&D estimate that we had talked about earlier.

Mr. VISCLOSKY. So those figures are part of your $179.8 million——

General JAQUISH. Yes, sir. Eighteen million dollars of the $180 million in 1994 is for live fire testing and the to-go cost, $120 million and $130 million includes the second $18 million and the $4 million in 1996.

We should be coming forward to you some time this summer with a request to authorize component testing versus full-up.

Mr. VISCLOSKY. So the live fire testing program would extend past what we consider the live fire testing program for the C–17?

General JAQUISH. There is $4 million in 1996 and that is for clean up and writing reports. There is $18 million in 1995, but that is a part of the EMD testing.

C–17 FLIGHT TEST SCHEDULE

Mr. VISCLOSKY. In terms of the schedule—and I don't need to go down memory lane—you have acknowledged that the original program was ambitious. I spent Friday of last week at Edwards and one of the terms used by those flying the aircraft is that they have "hung their hats" on the new schedule and recognize the importance of meeting it and believe that they have built in a good, sound safety factor and are not pushing at the outer limits.

Is it your belief that this is a firm schedule and that that December 1994 to January 1995 schedule will be met?

General JAQUISH. There are always unknowns. For the first time, we have laid in the right kind of flight test months. We have brought the P–5 back into flight testing. There is no reason at this point not to be able to execute that flight test program.

Mr. VISCLOSKY. A concern is the problem of concurrence in terms of the decisions we face with the C–17, that we get too far down the road and the decision is no longer in our hands. We want a sound schedule.

General JAQUISH. In February, subsequent to the hearing we had on the C–17, we completed our initial look at the physical and functional configuration audit on P–5 and we released nearly 100 percent of the engineering drawings at that time.

There are some clean-up items we have to work on. We believe we have the final configuration design in hand. As you get into that flight test, if you find there is fine-tuning, you have to go back and address those.

DOD IG REPORT ON C–17

Mr. VISCLOSKY. The Air Force report on the allegations made by the Department of Defense Inspector General—IG—was to be submitted by the Office of the Secretary of Defense by April 20 of this year. Do you know if that report was submitted to the office?

General JAQUISH. The Acting Secretary of the Air Force has submitted that report to the Deputy Secretary of Defense today and the report, from the Air Force perspective, the independent look at it is complete. That is now in the hands of OSD. The report has not been released at this time.

Mr. VISCLOSKY. Would you feel free to comment on the Air Force position as they related it to the office?

General JAQUISH. I can't at this point. It has not been released.

Mr. VISCLOSKY. Thank you very much. Thank you, Mr. Chairman.

PROGRAM STRETCH-OUTS

Mr. DICKS. Mr. Darden?

Mr. DARDEN. Thank you, Mr. Chairman.

Mr. Chairman, while you were voting and when there was some exchange going back and forth a while ago, I addressed the same area of inquiry you did about the slippage and moving to the right of the F–22 program.

What is I guess the most frustrating thing to me has been borne out by the line of questioning by our colleague from Indiana.

It seems we keep slipping these programs to the right, delaying them and eventually, as in the case of the B–2 and C–17, the congressional support seems to wane because we never seem to build anything, we always move it to the right and test it some more and restructure it.

I don't know what the solution to this problem is, General, but it impacts not only the cost of a program tremendously, but it puts supporters of a particular program in a very difficult situation because the longer that these programs are stretched out, the political reality of being able to appropriate large sums of money becomes less and less likely.

That is a situation that we are getting—we have gotten into long ago with the C-17 and that is the problem that I foresee happening in the F-22 and I think that is part of the Chairman's concern here as well. Then if we finally restructure it one time—I understand that the contractor was behind this to a certain extent as well, maybe not taking a lead role, but certainly a willing participant; now that we have finally restructured the F-22 this last time, I wish you would note that these further restructurings continue to jeopardize the fact that we will have an air superiority fighter.

I guess I don't know how to emphasize this more and more. I look around and I am not sure, Mr. Chairman and Mr. Visclosky, but you and I will probably be gone long before anything will be flying.

General JAQUISH. I agree with your comments with regard to restructures and continuing to stretch programs. There is one fundamental difference.

The F-22 is a cost-plus contract so you pay the contractor for work accomplished and in this case it was strictly a financial decision.

There is no technical problem associated with this program. We just completed a preliminary design review and they went through 3,171 closure plans items on the airplane and only 20 remain open. They will be closed out later this month.

Mr. DARDEN. Only 20 of how many?

General JAQUISH. Three thousand, one hundred and seventy-one. That is an unprecedented success in a preliminary design review at this point in time. This design is significantly more mature than you would otherwise anticipate.

In contrast, the C-17 was done in a fixed-price contract situation, and in fact, on the C-17 because the contractor was losing money. We had a lot of problems with his ability to respond to technical problems, management problems and quality problems.

It is for a totally different set of reasons, but the outcome is the same, if you continue to stretch these programs, you can lose support.

It was strictly a funding decision with regard to the F-22. 1994 and 1995 were tough years for us when we pulled together our budget and that was the basis of the decision.

Mr. DARDEN. I think the number of B-2s could have been easily three times the twenty had we not experienced delays. What bothers me is I hope I am wrong and you have allayed my concerns somewhat, but I just see the F-22 program going the way of the C-17 and the B-2 and it concerns me.

General JAQUISH. There is another difference. By the nature of the contract, as I said, cost plus, the contractor associated with the F-22 by definition will make a reasonable profit.

If you go back through the C-17 story that we went through in some detail several weeks ago in a fixed-price environment that contractor is losing $1.1 billion. So there is a very different set of circumstances here between the two programs.

That is why the Department at your urging, and all four committees endorsed this, adopted a policy that we will no longer do fixed-price contracting unless there is a minimum or no risk.

Mr. DARDEN. Without being argumentative, we were told—and I realize this was before your term and I don't impute any personal responsibility on your part at all—but we were told throughout the time that the C–17 was being pushed by the Air Force that this represented no real new technology that it was a matter of bringing it off the shelf, putting it together and flying it off.

General JAQUISH. The C–17 is not a great technical challenge. It never has been. Now we had problems in that program as we went over the other day for a lot of other reasons.

It had mainly to do with the fact that the contractor ended up losing a significant amount of money on the program. The program became unexecutable from that perspective. That will not happen in the F–22.

Mr. DARDEN. Thank you.

Thank you, Mr. Chairman.

Mr. DICKS. Supporters of the F–22 worry that when decisions to stretch it out are made there are always other things that happen. People question do we really need to do this or should we keep the F–16 going, the F–15E—you get all these other ideas.

There was a lot of momentum behind the F–22, but when you start talking a number of additional years, I just worry about problems occurring. I don't think they are technical problems, which we did have in the B–2, or producibility problems as in the C–17. I don't think there are any technical issues with the F–22. It is just that it takes so long, that political and funding problems can occur with other competing programs.

OVERHEAD RATES

I have one additional—one more question about overhead rates. It is not a very popular issue, but are you worried that with a lot of your major contractors having fewer and fewer defense programs because of the cutbacks that the overhead rates are going to be a problem for you?

General JAQUISH. Absolutely.

Mr. DICKS. Is there anything we can do about this?

General JAQUISH. One of the things we have done in the F–22 meeting with the CEOs of the companies involved, discussion of overhead rates has been on the front burner and those companies have responded significantly to that.

In addition, control of overhead rates has become one of the criteria for our award fee in the F–22. On the other side, the contractor's ability to respond to overhead rates is like his ability to respond to inflation. It is there. It is something they have to deal with.

They have been downsizing at a great rate. They are laying off as many people as they can. They are selling off excess capacities and excess capabilities as we speak, but it is a national problem and it is one that is going to have to be addressed across the industry.

As DOD budgets continue to go down and that business base erodes over time, it is going to be a more and more significant problem.

GATS/GAM PROPOSED

Mr. DICKS. For the record, provide a cost estimate and timetable for the GPS Aided Targeting System/GPS Aided Munition (GATS/GAM) proposal.

Could you do that for me?

General JAQUISH. Yes, sir. I would like to be able to do that after we speak to the Chief. We will provide that for the record.

[The information follows:]

Answer. The Air Force has completed a preliminary evaluation of the GATS/GAM proposal. General McPeak approved proceeding with GATS/GAM using a two-phased program. The first phase will test the GATS concept with a limited amount of GAM test assets to prove the concept. If successful, the Air Force will proceed with the second phase. The second phase will procure 128 GAM weapons for a B-2 near precision capability. Contract award will be in FY 95 to support weapon delivery in mid-FY 96. The Air Force will request Congressional authority to begin in FY 93.

If GATS is started by July 1993, a single-target capability will be available in mid-FY 96 with full multiple target capability available in mid-FY 97. Currently, the B-2 is the only weapons platform scheduled to have this capability, although the benefits of GATS could potentially provide greater accuracy to any aircraft with a Synthetic Aperture Radar (SAR). The funding required is depicted in Figure 1. The top line is currently in the B-2 program for Joint Direct Attack Munition (JDAM) 1 integration. The second line represents what is required for the GATS/GAM program in FY 93-95(−), and what is not needed in FY 96-97 (+), for a total of $67 million required. This funding includes full JDAM 1 integration, full GATS/GAM capability on all 20 operational aircraft, and 128 GAM weapons.

Budgeted (TY$M)	FY93	FY94	FY95	FY96	FY97	TOTAL
B-2 JDAM 1 funding	22	26	32	31	28	139
Delta-GATS/GAM Program	−9	−48	−45	+10	+25	−67

Note: Includes full JDAM 1 integration.

B-1 CONVENTION CAPABILITY

Mr. DICKS. On the B-1, is it going to cost us $2.5 billion to put a conventional capability on the B-1? The question is, since the B-52 R&D conventional conversion is almost complete and there are plans to make the B-2 conventional, what would be the impact of not appropriating the additional $2.5 billion? What would be the capability of the B-1B if these additional funds are not appropriated?

General JAQUISH. The $2.5 billion includes all R&D and procurement associated with all the mods for the B-1 associated with both conventional——

Mr. DICKS. So that money is not just for conventional?

General JAQUISH. Conventional, radio, ECM, computer upgrades, without that $2.5 billion, you have a superb airplane that essentially doesn't have any conventional capability. It can carry 500 pound bombs now, but that is it.

Mr. Dicks. They would be all dumb weapons, no smart weapons?

General Jaquish. Yes. We are working to get JDAM 1, JDAM 3, TSSAM JSOW, and all those weapons on the B-1.

B-52 BOMBER PROGRAMS

Mr. Dicks. What are we doing with the B-52's?

General Jaquish. We will retire the last of the B-52G's I think in December of 1994 and we are taking the conventional capabilities in the B-52G's and putting them on 47 of the newer more capable B-52H's. We will end up with a bomber force of 20 B-2's, 95 B-1's, and 95 B-52H's.

Mr. Dicks. Does it make sense to do that instead of upgrading?

General Jaquish. Yes, sir.

The H is a better plane, newer, more fuel-efficient, and its life cycle costs are lower on an annual basis to the tune of $40-million.

ADVANCED CRUISE MISSILE PROGRAM

Mr. Dicks. The Advanced Cruise Missile program has been terminated at 460 missiles. There is $25.4 million requested in the fiscal year 1994 budget. Is that correct?

General Jaquish. Yes, sir. The remaining R&D money is $42.3 million spread across 1994 to 1996. That is depot support for the guidance sensor and software.

The $25.4 million that is in the 1994 budget goes to depot support for ACM. We have closed out ACM in terms of production.

F-16 SQUADRONS

Mr. Dicks. What are you doing on F-16? The fiscal year 1994 R&D request for F-16 squadrons is $116.9 million. Last year it was anticipated that $213.7 million would be required in fiscal year 1994. Why has this program changed?

General Jaquish. Several reasons. One, when we made the decision to procure additional airplanes we reduced, the modification accounts and funding associated with that airplane to pay for the procurement.

So we offset out of the mod accounts on to the procurement side. In addition to that, we have significantly changed our approach for close air support in the F-16.

We were in a position where we were going to fund close air support modifications on our existing block 30s with a new helmet-steered FLIR and now we have elected to put additional modifications on existing block 40 airplanes that are Lantirn-equipped and that netted a total savings of $2.3 billion.

MULTI-ROLE FIGHTER FUNDING

Mr. Dicks. $6.6 million is requested for feasibility studies for a follow-on multi-role fighter. Why are these funds required in fiscal year 1994?

General Jaquish. That is a slight mistake. It is actually $4.4 million and it was our mistake, not yours. It is $4.4 million. We were looking to do some requirements work and some concept exploration kind of work prior to milestone zero that at the time we thought was going to occur in 1996.

Now, as part of the bottoms-up review, the multi-role fighter, the follow-on to the F-16 is part of that review. We have spent, I think, $2 million on studies and this is just continuing that study work.

Mr. DICKS. Thank you, General. This was a very good hearing and we appreciate your good testimony; Mr. Mattice, too.

We have other questions for the record. The Committee is adjourned until 10:00 a.m. tomorrow.

[CLERK'S NOTE.—Questions submitted by Mr. Dicks and the answers thereto follow:]

MILSTAR PROGRAM

Question. In understand that Milstar will be part of the bottom up review. What is the current status of the Milstar program, both space assets and the core terminals?

Answer. Milstar is a part of the Bottom Up Review which has the purpose of ensuring the program is structured to provide the best fit for the Department of Defense given the current threat and force structure requirements. Milstar was rebaselined during the October 1992 Defense Acquisition Board (DAB). The current program reflects a reassessment of Military Satellite Communications (MILSATCOM) requirements and investment strategy. It was decided the requirements for polar coverage did not merit the expense of two Milstar satellites. The Milstar constellation was rebaselined from six to four satellites for mid-latitude coverage. The Air Force was directed to study different alternatives for a cheaper Milstar compatible polar adjunct system to respond to the high latitude or polar coverage requirement. The Air Force is on track to report back to the DAB with a recommendation in April 1994.

The Milstar satellites are categorized as Milstar I satellites—those with the Low Data Rate (LDR) and crosslink payloads, and Milstar II satellites—those with the LDR, Medium Data Rate (MDR), and crosslink payloads. There are currently two Milstar I satellites planned for launch (Satellites 1 and 2). Satellite 1 has been delivered to the Air Force and launch is planned for later this calendar year. Satellite 2 is 90% complete, undergoing factory integration and testing. It is due for delivery and launch in 1994. Both these satellites will support operational test activities and provide an initial communications capability for hard core and core command and control requirements. Satellite 3 was initially planned as a Milstar I satellite; however, in deliberations over the 1993 budget request, we elected to modify it to incorporate the Milstar II MDR payload. Negotiations for this change are underway. The satellite has 60% of the LDR work completed and will be stored for modification with the MDR payload after Satellite 4. We currently intend to launch modified Satellite 3 as the second MDR satellite. Satellite 4, a new build Milstar II satellite, is planned for launch in the year 2000.

The Milstar 1991 Restructure, agreed to by Congress, was further refined during the October 1992 DAB. We are buying somewhat fewer core terminals which we call the Air Force Command Post Terminal (CPT), due to continued force structure reductions. We have also complied with guidance to downselect to a single source for purchasing the remainder of these terminals. The CPT buyout will be completed using prior year money; the price has been reduced more than 50 percent through competition. The first Low Rate Initial Production CPT terminal was installed in August 1992.

NATIONAL AERO-SPACE PLANE (NASP)

Question. In your testimony, General, you indicated that the Air Force is committed to the NASP program. While I supported this program in the past, it has become a very expensive program. What is there in the existing or restructured NASP program that will maintain the U.S. lead in this technological field? Will this give us any kind of "Quantum Jump" beyond what the Russians or the French have already accomplished?

Answer. The Air Force is committed to the NASP program. The proposed restructured NASP program, which combines hypersonic flight experiments with a complementary ground-based program, will allow the U.S. to maintain its lead in this technological field. The hypersonic flight experiments would progressively investigate the critical unknowns: boundary layer transition; scramjet engine design and operability; and integrated scramjet performance and vehicle stability and control. These experiments, conducted at Mach 12 to 18, could provide test data at conditions that cannot be achieved in current ground-test facilities. Existing surplus U.S. missiles, such as the Titan and Minuteman II systems, are now available to serve as "flying wind tunnels" by boosting the experiments to the required test conditions. The ground-based program would continue to investigate, at a reduced level of effort, other single-stage-to-orbit enabling technologies such as structures, materials, subsystems, thermal protection, and computational tools.

The proposed restructured program would keep us well ahead of our international competitors in this technological field. To the best of my knowledge, the tests by the Russians and the French were conducted in the Mach 5 to 6 regime where we already have a good understanding based on our ground tests, and there have been no boosted experiments tested at Mach 12 and above. This region remains a critical unknown and is the primary focus of the proposed restructured NASP program.

Question. The Air Force request for FY94 for NASP $43.3M, while NASA's request is $80M. Is $43M adequate to continue technological progress? If so, what will be the end product? If not, what funding level should the committee support?

Answer. No. The $43.3M Air Force request for NASP is not sufficient to continue technological progress on the national initiative. The NSAP national initiative is structured to include both Air Force and NASA funding. The Air Force and NASA requests of $123.3M combined represent the minimum funding level required to complete the remaining Phase 2D activities and begin preliminary planning for a restructured NASP program.

Since NASP program funding is allocated against planned activities based on technical criteria and goals and not necessarily with relationship to which agency funds were appropriated, appropriated funds will be applied to achieving the overall NASP program goals and activities. Some of the "end products" of the next year's efforts will be:

A large-scale, fully integrated ramjet/scramjet engine, the Concept Demonstration Engine (CDE), which will be tested at Mach 5 and 7; coupon and panel-size (approximately 2' × 2') engine test articles made of advanced materials which will be characterized and tested; engine panels designed and manufactured with active-cooling systems which will be tested at simulated hypersonic heat loads in the range of 1000–1800 degrees Fahrenheit; a preliminary design of the proposed hypersonic flight experiments; and NASP technology transfer to the civil and commercial sector

The committee should support the President's Budget request of $43.3M for the Air Force contribution to the NASP program.

F–22 PROGRAM

Question. As you know, I am very supportive of the F–22 program. I certainly understand the need for Air Superiority in the 21st century, and I believe this is the plane to do the job. However, I am very concerned about the Air Force's rephasing of the EMD schedule. I am concerned about the amount of time and money that it is taking to develop the airplane and put it on the runway. As I understand it, the program is modeled exactly after the Packard Commission requirements: no concurrency, the program has to be checked and double checked, and I realize this requires time.

The EMD schedule calls for ten years of work at a cost of $10B to develop flight tests, and check all the systems for the nine airplanes. This comes of course after an extensive prototype/development program where the contractors built, tested and flew two planes and achieved excellent results. Why a ten year EMD phase? Can this be shortened? How could it be shortened?

Answer. The Air Force has a well thought out schedule for F–22 EMD that takes into account lessons learned from F–15, F–16 and YF–22 development. The integrated master schedule and integrated master plan carefully balance risk, schedule and cost. Funding stability is also a major factor affecting all three areas. The current length of the EMD program is modeled after the Packard Commission recommendations, the acquisition improvements embodied in the most recent DOD 5000 series regulations, and the most current industrial techniques. The EMD program was also lengthened 2 years as a result of the Major Aircraft review and an additional year due to recent rephasing for budgetary reasons. The only way to shorten the program is to increase funding starting now. It is a hard lesson and takes discipline in our system to afford ourselves the upfront time to plan, design, and test so that production is smooth and at the least cost to the Government and the contractor. With your support, we have maintained this discipline and will continue to do so.

Question. Is it a question of technical development or a question of the availability of funds?

Answer. The Air Force has a well thought out schedule for F–22 EMD that takes into account lessons learned from F–15, F–16 and YF–22 development. The integrated master schedule and integrated master plan carefully balance risk, schedule and cost. Funding stability is an important factor affecting all three areas. The length of the EMD program is affected both by technical development and availability of funds. Monumental strides have already been made in technical areas of this program because we have taken a disciplined, event driven approach. we will continue that discipline in avionics development, the area currently considered as having the greatest potential risk. We're confident the ground avionics laboratory, airborne flying lab, and full mission simulator activities minimize the risk for avionics development. As for funding, at this point in the program when the detailed design is being accomplished, funding stability is of major importance. A funding reduction would slow the program's pace, increase cost, and would not reduce risk. This view was also voiced by the Defense Science Board assessment of F–22 program development.

Question. What are the trade-offs if the EMD schedule is truncated down to say seven years?

Answer. If the program were shortened to seven years, there would have to be a decrease in the Engineering and Manufacturing Development (EMD) effort (content), or a significant increase in the concurrency of designing, building, and testing the EMD hardware and software. Either of these changes would have to be weighed against the increase in development risk, particularly in avionics development. If concurrency of development activities is increased to shorten the EMD period, then technical and schedule risk increases and there would be a significantly increased funding requirement in fiscal year 1994, and following fiscal years. If content is deleted, there may be some savings generated in those seven EMD years, but these savings would be more than offset by the risk created by not doing all of the currently planned EMD tasks. The result would be an increased quantity, severity, and cost of engineering changes required in the early production aircraft—an expensive penalty for not completing a thorough EMD. We are confident the current schedule is appropriate based on program risk, the threat, and the useful service life of the F–15.

[CLERK'S NOTE.—End of questions submitted by Mr. Dicks. Questions submitted by Mr. Sabo and the answers thereto follow:]

JOINT SEISMIC PROGRAM

Question. For the last three years, Congress has added money to the Air Force budget for the Joint Seismic Program, administered by the Incorporated Research Institutions for Seismology, which involves the placement of seismic sensors in the former Soviet Union and other areas of proliferation concern. This activity is designed to assist in the verification of future possible international agreements to limit the testing of nuclear weapons, and is consistent with the Air Force's seismic monitoring mission.

I have been told that the Air Force, for the first time, has requested money in its budget for this activity. Is this correct? If so, at what levels?

Answer. No. The Air Force has not budgeted funds in the basic research or the exploratory development programs to support the Joint Seismic Program. In accordance with the guidelines established for the RDT&E accounts, the Air Force did not budget for construction, maintenance, or other operational costs required to collect seismological data.

Question. Is there money in the budget for the associated university-based research program?

Answer. Approximately $4M will be requested for associated university-based research for FY 94 in Program Element 0601102F, Project 2309.

Question. Can you provide us with an update on this program?

Answer. In PE 0601102F, a total of $2.670M has been allocated to support seismic research at U.S. universities in FY 93. The universities to be supported include the University of Arizona, Harvard University, the University of California at Santa Cruz, the University of California at Berkeley, the University of Southern California, the California Institute of Technology, Columbia University, the University of Texas at El Paso, Southern Methodist University, the Pennsylvania State University, Saint Louis University, and the Massachusetts Institute of Technology. A continuation of funding is planned in FY 94 for at least six of these universities. An additional $0.700M of FY 93 funds has been designated for grants and contracts to universities for collaborative research with the Air Force Phillips Laboratory. $0.096M has been awarded to the University of Oslo and the Australian University for seismic research.

Question. IRIS has argued that its stations are unique, since they provide seismic data from the territory of the former Soviet Union. To your knowledge, are there any other operating seismic stations in the former Soviet republics to which the US has access?

Answer. The US has access to a number of operating stations in the FSU besides the IRIS stations. The Advanced Research Program Agency (ARPA), supported by the Air Force Technical Applications Center (AFTAC), has a program underway with the Russian Ministry of Defense (MOD) Seismic Services to share real-time seismic data for monitoring purposes. Through this program, in six months AFTAC (through ARPA) will have access to data from 10 locations within Russia; four are close to existing IRIS stations. These Russian MOD stations are quiet sites (for seismic monitoring purposes), ideal for low threshold monitoring, with a long historical record to baseline current activity. As a historical complement to this data, the US has obtained and digitized 536 seismic recordings of 91 Soviet nuclear tests (including peaceful nuclear explosions) from 11 FSU stations: Apatity, Arti, Bodaybo, Noril'sk, Novosibirsk, Talaya, and Tupik (all in Russia), Chusal (Tadzhikistan), Frunze (Kirgizistan), and Uzhgorod (Ukraine). These include stations operated cooperatively by the Soviet Academy of Sciences and the MOD Seismic Services.

In addition to existing Russian sources, ARPA recently installed two high performance seismic arrays at FSU seismic stations in Russia and Azerbaijan; data from these arrays are being received in real-time at the Center for Seismic Studies (CSS), Washington, DC. AFTAC has an Internet connection to the CSS and uses this data for on-going research. A third high performance array is scheduled for installation later this year in the former Soviet Republic of Turkmenistan.

It should be noted that locating seismic stations in the FSU does not necessarily enhance seismic monitoring of activity within the FSU. As the US agency responsible for monitoring a number of nuclear related treaties AFTAC operates the US Atomic Energy Detection System (USAEDS), a worldwide network of sensors (including seismic) to detect and measure various phenomena associated with nuclear detonations. ———.

The study also showed that IRIS stations (some of which are not presently operational) are in locations far too noisy for effective low threshold explosion monitoring, and do not routinely detect these events at distances greater than 500km from the stations. From this perspective, the value of the IRIS stations as a potential adjunct to the existing USAEDS capability for locating and identifying nuclear explosions is marginal at best.

Question. I understand that the Air Force Tactical Applications Center has been working with other agencies of the federal government to determine what technologies and deployed systems we would need to improve our ability to verify a future test ban treaty. Can you provide us with additional information on that work?

Answer. The Air Force Technical Applications Center (AFTAC) works with several agencies to determine what technologies and deployed systems could improve our ability to verify a future test ban treaty. Working with the Advanced Research Program Agency (ARPA), AFTAC has formulated a Comprehensive Test Ban (CTB) Readiness Plan, which discusses how the US could monitor a CTB using seismic, hydroacoustic, and satellite sensors, and particulate and gaseous sampling techniques. The plan emphasizes international data sharing using these techniques to improve our ability to verify low-yield nuclear tests.

AFTAC also works with the Department of Energy on several seismic R&D efforts to improve monitoring capability. These include improved regional discrimination of seismic events, development of the AFTAC Distributed Seismic Network (ADSN) program, use of the Deployable Seismic Verification Systems (DSVS), and test and development of advanced technology seismometers.

The US Geological Survey (USGS) participates in joint efforts with AFTAC to improve abilities to verify a CTB. The Auxiliary Seismic Network (ASN) program ——— deploys seismic stations in the southern hemisphere to improve our ability to monitor in those regions ———.

Question. Does the Air Force envision retaining a permanent role in seismic monitoring? Is it possible for the Air Force to be involved if monitoring and verification networks are required by treaty to be open and unclassified? Should the Air Force maintain a separate system of classified seismic sensors in addition to an international network of open stations?

Answer. The Air Force envisions a permanent role in seismic monitoring. The Air Force Technical Applications Center (AFTAC) mission includes monitoring foreign compliance with the 1963 Limited Test Ban, the 1974 Threshold Test Ban, the 1976 Peaceful Nuclear Explosions; ——— Treaties. To accomplish this, AFTAC operates a worldwide network of sensors to detect and measure various phenomena associated with nuclear detonations; seismic stations are critical components of this network.

Air Force involvement in treaty-required open and unclassified monitoring and verification networks is possible. ———.

Beyond this, AFTAC and the Advanced Research Program Agency (ARPA) have developed a Comprehensive Test Ban (CTB) Readiness Plan, which discusses how the US could monitor a CTB using seismic, hydroacoustic, and satellite sensors plus particulate and gaseous sampling techniques. The plan emphasizes international data sharing using information from these techniques to improve our ability to verify low-yield nuclear tests.

Whether or not the Air Force should maintain separate systems of classified and open sensors depends on a number of issues, including the importance, utility, and availability of the information involved and the importance and feasibility of an independent US monitoring and verification capability. Intelligence requirements generally dictate the protection of collection sources and methods to ensure their continued availability. Often, data collected using these methods is protected by a targeted country of interest and not available through cooperative information exchanges or collected with the assistance of an entity that prefers its involvement remain unknown. We envision AFTAC will retain all available and useful data sources, including seismic, material sampling, and satellite sensors, and will continue to fuse both classified and unclassified sensor data sources into a single product, when appropriate.

[CLERK'S NOTE.—End of questions submitted by Mr. Sabo. Questions submitted by Mr. Lewis and the answers thereto follow:]

NATIONAL AERO-SPACE PLANE (NASP)

Question. General Jaquish, in your statement you state that the Air Force is fully committed to the National Aero-Space Plane (NASP). Yet, only $43.3 million is included in the fiscal year 1994 request for NASP. Please reconcile these statements.

Answer. The Air Force is committee to the NASP program. The Air Force request of $43.3 million along with the NASA request of $80.0 million, for a total program request of $123.3 million, will allow the NASP program to complete the remaining activities under the current phase, Phase 2D. In addition, the Air Force and NASA program will be able to begin preliminary planning for a restructured NASP program which supports the Administration's desire for DoD and NASA to work with the Office of Science and Technology Policy to ensure that hypersonic research plays an important role in a balanced national aeronautics strategy.

Question. What is the Air Force's plans for the $43.3 million?

Answer. With the Air Force request of $43.3 million and the NASA request of $80.0 million, for a total request of $123.3 million, the NASP program will complete remaining Phase 2D activities and begin preliminary planning for a restructured NASP program. The NASP program allocates appropriated funding against planned activities based upon technical criteria and goals, not necessarily with relationship to which agency the funds were appropriated. Therefore, the Air Force plans for its request will be applied to achieving the overall program goals and activities. The major activities and tests remaining under Phase 2D include:

Test and analysis of the Concept Demonstration Engine (CDE); a large-scale, fully integrated ramjet/scramjet engine to be tested at Mach 5 and 7

Test of remaining engine materials and the materials characterization of coupon and panel-size (approximately 2′ x 2′) engine test articles

Test of actively-cooled engine panels at simulated hypersonic heat loads in the range of 1000–1800 degrees Fahrenheit

Continued transfer of NASP technologies to the civil and commercial sector

Question. How much is included in the NASA fiscal year 1994 budget for NASP? For what purposes?

Answer. NASA has requested $80.0 million for NASP in the FY 1994 budget. With the Air Force and NASA requests of $123.3 million combined, the NASP program will complete remaining Phase 2D activities and begin preliminary planning for a restructured NASP program. The Air Force and NASA funding is combined at the beginning of the fiscal year to accomplish the planned program objectives. The NASP program is managed in such a way that it does not differentiate which part of the program the Air Force will fund and which part NASA will fund. Therefore, the NASA plans for the FY 1994 budget request will be used to achieve the combined program objectives. The major activities and tests remaining under Phase 2D include:

Test and analysis of the Concept Demonstration Engine (CDE); a large-scale, fully integrated ramjet/scramjet engine to be tested at Mach 5 and 7

Test of remaining engine materials and the materials characterization of coupon and panel-size (approximately 2′ x 2′) engine test articles

Test of actively-cooled engine panels at simulated hypersonic heat loads in the range of 1000–1800 degrees Fahrenheit

Continued transfer of NASP technologies to the civil and commercial sector

Question. Each year, NASA funds for NASP are not appropriated. The fiscal year 1993 Defense Authorization Act prohibits the Air Force from expending more than twice what is appropriated for NASP in NASA. If, once again, there are no NASA funds appropriated for NASP, does that mean the NASP program is finished? Or will some of the technologies be spread among the other tech base accounts?

Answer. Yes, since the FY 1993 Defense Authorization Act restricts obligation of funds for NASP to no more than twice what is appropriated to NASA for the NASP program, then if NASA is appropriated no FY 1994 funds for NASP, the NASP program as a *national* effort will cease to exist. However, the Air Force is optimistic that Congress will support the NASA funding request for NASP. Each year, with the exception of FY 1993, Congress has provided some NASA funds for NASP.

If the NASP national initiative is terminated some of the ongoing technologies will be considered for further development, however, that will not happen in FY 1994. Any NASP follow-on technology efforts will not be considered for funding prior to FY 1995.

[Clerk's note.—End of questions submitted by Mr. Lewis. Questions submitted by Mr. Skeen and the answers thereto follow:]

SPACE-RELATED INFRASTRUCTURE

Question. General, you discussed the importance of space systems and the importance of controlling the high ground. I am concerned that the budget request does not provide adequate funds to maintain our space-related infrastructure and provide needed funds for on-going RDT&E programs. Would you comment on this matter and give this committee your opinion and the Air Force's perspective on this matter?

Answer. The Air Force has budgeted considerable funds in FY 94 for the purpose of maintaining and upgrading our space-related infrastructure. A major element of this is our space launch infrastructure. As a matter of fact, the FY 94 budget request has much more funding for this area than in prior years.

Specifically, we are making essential repairs to the most critical facilities at our launch bases. We are repairing buildings, replacing air conditioning and heating systems, and overhauling utilities. Also, we are replacing aging range electronics needed for all launches and in FY 94 will continue a project to improve the reliability and lower the operating cost of range systems, the Range Standardization and Automation (RSA) project. The RSA project is the first effort in over thirty-five years to undertake development in order to improve the manner in which we modernize, operate, and maintain the space launch ranges.

For our current launch vehicles, we are making essential modifications needed to ensure our ability to protect life and property during launches. The FY 94 budget request also includes funding for better launch support facilities and ground support equipment needed for better safety and improved efficiency.

One of the most vital areas included in the FY 94 budget concerns not our current capability, but the future of our space launch capability. Numerous studies conducted over the past several years have confirmed what we have known for some time: our present launch systems have some operational deficiencies. The Atlas, Delta, and Titan boosters are all derived from first-generation ballistic missile technology. As a result, they are more costly, more difficult to operate, and less reliable than our current state of technology can produce. The Air Force recognizes that a cost-effective and robust space launch capability is vital to the Nation's future. For that reason we have requested funding in FY 94 to pursue the concept exploration of a new system to meet military, civil, and commercial needs starting early in the next century.

In summary, the FY 94 budget does a good job of addressing our most urgent problems, those which threaten the very viability of our space launch capability, and those vital to ensuring the Nation's future space capabilities. There are other areas for investment, as yet unfunded, which offer the potential for further improvements, and we hope to address these in future budget years.

HIGH ENERGY LASER SYSTEMS TEST FACILITY (HELSTF)

Question. General, you may or may not be aware, but the High Energy Laser Systems Test Facility (HELSTF) is located at White Sands Missile Range, in my district in southern New Mexico. I would like to briefly discuss this item with you for a moment, and you are certainly welcome to provide any answers for the record, if necessary.

As you know, the program is operated by the Army's Strategic Command, and the FY 1994 DoD budget has proposed closing this facility.

General, I am extremely concerned about this action. In my opinion, closing HELSTF would close the door on many future technological capabilities for the U.S. Armed Forces by precluding cost effective evaluations of the concepts. Additionally, I am very concerned that, if HELSTF is eliminated, the country's only functional ASAT contingency capability will be lost.

I understand the Air Force and Space Command discussed the utilization of this facility in future years for space-related tests and programs.

Would you provide for the Committee any comments on the importance of this facility and any plans the Air Force currently has to utilize this facility in future years?

Answer. The High Energy Laser Systems Test Facility (HELSTF) has contributed to our understanding of high power lasers. The Mid-Infrared Advanced Chemical Laser (MIRACL) device and its associated SEALITE Beam Director, the only operating facility at HELSTF, constitute a unique capability—it is the only integrated megawatt-class laser device/telescope in the nation. However, the MIRACL/SEALITE laser has limited capabilities for further lethality testing or technology related experiments due to its older technology, its long wavelength and thermal blooming characteristics, and the power scaling limitations of the hardware. The Air Force does not believe that the current configuration has any functional anti-satellite contingency capability. Considering both lethality testing and ASAT needs, the Air Force does not have any requirements that would justify maintaining the HELSTF.

[Clerk's note.—End of questions submitted by Mr. Skeen. Questions submitted for the record and the answers thereto follow:]

OVERHEAD RATES

Question. One of the biggest problems facing the Department's acquisition programs is the cost growth programs are experiencing because of the declining business base resulting in contractor overhead growth. Overhead growth is due to contractor losses due to cancellation of other programs, which places the majority of the costs onto a single program. It is also due to the fact that most procurement contracts of a company are fixed price ones which places the overhead on the cost type R&D contracts. What is the Air Force doing for the near term—fiscal years 1993 and 1994—to force the contractors to get a handle on their overhead? The far term?

Answer. While the principal agency for review of contractor overhead is the Defense Logistics Agency (Defense Contract Management Command (DCMC)), the Air Force has substantial interest in the subject. We understand its effects and are concerned with the impact on our programs. At the request of the Secretary of the Air Force, an overhead review was accomplished on the major contractors involved in the F–22 program. We have cooperated, and will continue to cooperate, with the DCMC to review contractors who may be identified as experiencing rising overhead rates. A policy statement has been prepared and will soon be published which advises Air Force program managers to consider the need for overhead "should cost" studies when there is an unsupported rise in contractor's overhead costs. Overhead should cost reviews will be supported by our program offices and with other specialists as appropriate. Program offices and Program Executive Office staffs are aware of the need to support and participate as required in overhead reviews. Contractors are aware of rising overhead costs and are generally working to reduce them. If they don't, they quickly become non-competitive. But, overhead costs do not decline at the same rate as direct costs. Total overhead costs may decline, yet the rate, because of a reduced base, may increase. In the long term we believe there will be some self correction as contractors adjust to the changing and perhaps reduced business bases. When reviewing contractor data and performance, the Air Force will continue to monitor and review programs, award fee plans, and other areas with special emphasis on overhead costs.

Question. What impact will these overhead costs have on the infrastructure (defense industrial base) of this country?

Answer. If left unchecked, overhead rates can adversely impact the affordability of future Air Force systems. Program terminations due to affordability can result in the loss of critical sectors of the defense industrial base. Additionally, this trend could prevent the successful integration of defense/civilian manufacturing, a key goal in our strategy to ensure Air Force access to a robust U.S. industrial sector.

Question. A good example of the overhead problem is the F–22 aircraft program. Lockheed, Boeing, General Dynamics, and Pratt and Whitney had several programs cancelled or delayed in a short period of time, such as the SRAM II, B–2, and F–16. What are these companies doing to get a handle on overhead costs in the F–22 program?

Answer. Lockheed, Boeing, Pratt & Whitney and all the companies associated with the F–22 program are working hard to divest themselves of unneeded capacity in order to reduce overhead. We have not yet seen the effect of Lockheed's purchase of General Dynamics' Forth Worth plant, but we ultimately anticipate a reduced overhead charge. All contractors are reducing excess manning. Plant capacity and machines are also up for sale. In a declining market (for Defense business) however, some of these assets are hard to sell.

Pratt and Whitney has drawn down from 8,400 to slightly less than 6,000 employees at their Florida facility as an interim step. They are currently negotiating the closure of 2½ plants in Connecticut that will impact capital equipment and 10,000 additional employees.

Monitoring overhead costs is a challenge and the F–22 SPO is currently implementing actions to track and control overhead costs. These include separating out overhead costs to improve visibility, improving the quality of cost and variance analysis, and "should cost" reviews for significant overhead cost changes. Also, overhead cost management is a separate criterion in the award fee plan for the F-22.

FIGHTER ROADMAP

Question. Has the Air Force evaluated what types and how many tactical aircraft are required to support the force structure (24.3 wing equivalents) envisioned in the fiscal year 1994 budget?

Answer. Yes, we have. The details of how many and what types of aircraft are contained in our budget submission for FY 94.

Question. One of the options raised by the Congressional Budget Office was that the Air Force retain only 18 tactical wings. General Jaquish, does the Air Force support such an option?

Answer. No, we do not. As we've testified before, the proposed 18 wing force is a high risk option with shortfalls that would jeopardize our capacity to pursue US national objectives and the National Military Strategy.

Question. What changes would have to be made to the fighter program of the Air Force if this CBO option is implemented?

Answer. It is difficult to speculate on specific changes to our fighter program since any alterations would have to start with changes to the National Military Strategy and our guidance from the Secretary of Defense. Without new guidance, there is no foundation to identify specific alterations to our fighter program. Generally speaking, however, we are confident there would be increased emphasis to accelerate fighter modernization and procurement in order to minimize risk associated with the reduced force.

Question. It has been estimated that the fiscal year 1994 budget contains approximately $7 billion (more than requested for the total RDT&E funding of the Army) for Navy and Air Force tactical aircraft modernization. What would be the impact to the Air Force's ability to complete its mission in fiscal year 1994 if funds were not provided in fiscal year 1994 for tactical aircraft modernization—in other words just maintain modernization at the minimum level required pending resolution of the OSD bottom-up and Odeen studies?

Answer. The Air Force RDT&E funding level requested in the FY 1994 budget already reflects the minimum level required to sustain the programmed force structure. Cuts below this level will impact the ability of the Air Force to sustain our programmed force structure in both the near and long term.

F-22 ADVANCED TACTICAL FIGHTER (ATF)

Question. One of the options raised by the Congressional Budget Office was to cancel the F-22 aircraft program on the grounds that its additional capability may be unnecessary and too expensive. CBO also states that other types of aircraft may prove to be more useful in future conflicts. Given these comments and the continued downsizing of tactical wings and the defense budget, why do you believe it is necessary to develop and procure the F-22 at this time.

Answer. Air superiority is the theater commander's first priority. It leverages all other operations. DESERT STORM proved its importance once again. The wrecked vehicles along the Highway of Death coming out of Kuwait City graphically showed what happens when a nation (in this case Iraq) didn't have air superiority. Air superiority is about the question, "Whose airspace do you want to fight in, theirs of ours?" The US has not lost a friendly soldier to enemy air attack in the career of anyone now serving in the US Army. We would like for that to continue.

The proliferation of state-of-the-art fighters and surface-to-air missile systems continues despite the changes in the former Soviet Union. These weapon systems are being delivered to the most unstable regions of the world—areas in which the US continues to have strategic interests. The F–22 is needed not just because it wins the fight, it is needed to get to the fight. Its combination of low observability and speed shrinks the SAM envelope so that enemy gunners can't react.

The USAF has continued to reexamine the need for the F–22. The 1990 major Aircraft Review and the 1991 Fighter Alternatives Study both concluded the F–22 was the most effective weapon system to meet the US's long term air superiority requirements. Upgrading existing hardware is not cost effective.

Question. A Defense News article indicated that the Office of the Secretary of Defense (OSD) is considering the merger of the F–22 and A/F–X programs. General Jaquish, are you aware of this review? What is the Air Force position on such a merger of these programs?

Answer. The F–22 and the A/F–X are intended for the distinctly different missions of air superiority and deep strike interdiction, so designing an aircraft that could meet all stated user requirements in both these areas would be technically risky and expensive. There is, however, potential for significant technology transfer from the F–22 to the A/F–X in the areas of avionics, engines, weapons, and materials. To consider such force structure questions, Secretary Aspin has initiated the Bottom-Up Review, the results of which will be available in late Summer 1993.

Question. The December 31, 1991, Selected Acquisition Report stated that the planning estimate for take-off gross weight for the F–22 is 50,000 lbs. What is the current weight estimate of the F–22 and when do you expect that the weight of 50,000 lbs will be met?

Answer. The purpose of the 50,000 lbs planning estimate was to reasonably constrain the contractors to a limit that would preclude unnecessarily heavy, and therefore, perhaps overly complex and expensive aircraft. The 50,000 lbs is not a goal that has to be met. Weight is not a contract requirement—aircraft performance is. If the aircraft can meet the maneuverability and range performance requirements, then it is acceptable to the Air Force. Currently, the aircraft's weight is about 60,000 lbs, and at this weight we are meeting all critical system characteristics. Weight control as it impacts required performance is a constant focus area for the Air Force and F–22 contractors.

Question. How confident is the Air Force that the F–22 will meet technical requirements and performance on schedule within currently programmed funding levels?

Answer. We are confident the F-22 will meet the user's requirements. We recently successfully completed the air vehicle Preliminary Design Review. The F-22 currently meets all critical system characteristics. The technical risk assessment conducted by the Defense Science Board (DSB) in February reinforces our confidence. The DSB concluded the risk areas have been identified and the management structure is in place to manage the risk. Our confidence in meeting this schedule is high because of the risk mitigation efforts on the demonstration/validation phase of the program and because the F-22 has the least concurrency between EMD and production of any fighter ever developed. The other major factor important to the F-22 remaining on schedule will be funding. If the program's yearly funding requests are met, there is every reason to believe the program will remain on schedule. A funding reduction would slow the program's pace, increase cost, and would not reduce risk. This view was also voiced by the Defense Science Board assessment of F-22 program development.

Question. What would be the impact on the F-22 program if this weight goal cannot be met?

Answer. Weight is important, but is not a contract requirement—aircraft performance is. If the aircraft can meet the maneuverability and range performance requirements, then it is acceptable to the Air Force. As determined in the recently successful Preliminary Design Review, the F-22 program is currently meeting all of its critical system characteristics, including maneuverability and range performance. Weight has in the past, and will in the future, be carefully monitored. We have done over 150 weight trade studies to date. The contractors have implemented an aggressive weight control program.

Question. The Preliminary Design Review (PDR) is scheduled for April 1993. Has the PDR been accomplished and what were the results?

Answer. The air vehicle PDR was held at the Lockheed Plant in Marietta, Georgia from 12-16 April 1993. The PDR was successfully completed and revealed that the F-22 program is on track and progressing smoothly. All acquisition program baseline critical system characteristics are being met. Over eighty subsystem PDRs were completed. The PDR activity is consistent with the F-22 program event-driven rather than schedule-driven philosophy. Completion of over 3171 closure plans was required to close the PDR.

Question. General Jaquish, what degree of confidence do you have that the scheduled milestones will continue to be on track?

Answer. Our confidence for meeting the scheduled milestones is high because of the risk mitigation efforts in the demonstration/validation phase of the program and because the F-22 program has the least concurrency between EMD and production of any fighter ever developed. Approximately 59 months separate EMD contract award from first flight, thus providing ample time for design, hardware component testing, systems integration, and software development. Earlier this year the program was rephased due to a combination of congressional cuts, contractor overhead increases, and program cost increases. In April we held a very successful Preliminary Design Review (PDR). Our next major milestone is Critical

Design Review (CDR) scheduled for August 1994. We firmly believe that the program will continue on schedule.

A major factor in the F-22 remaining on schedule will be funding. The Air Force is following an event driven schedule for the F-22. Completion of events is driven by available funding to accomplish the work associated with the event. If the program's yearly funding requests are met, there is every reason to believe the program will remain on schedule.

Question. For the record, please provide the original and current pertinent milestone dates.

Answer. The original and current milestone dates are as follows:

	Original Date	Current Date
Milestone I	Oct. 1986	Oct. 1986.
Milestone II	Jun. 1991	Jun. 1991.
Preliminary design review	Oct. 1992	Apr. 1993.
Critical design review	Oct. 1993	Aug. 1994.
Milkestone III	Dec. 1999	Jun. 2001.

Question. Overhead costs and other funding adjustments caused the F-22 EMD program to be rephased last November-December. General Jaquish, do the contractors have a handle on their overhead costs? What steps are the Air Force and the contractor taking to insure these costs are under control?

Answer. Lockheed, Boeing, Pratt & Whitney and all the companies associated with the F-22 program are working hard to divest themselves of unneeded capacity in order to reduce overhead. We have not yet seen the effect of Lockheed's purchase of General Dynamics' Forth Worth plant, but we ultimately anticipate a reduced overhead charge. All contractors are reducing excess manning. Plant capacity and machines are also up for sale. In a declining market (for Defense business) however, some of these assets are hard to sell.

Pratt and Whitney has drawn down from 8,400 to slightly less than 6,000 employees at their Florida facility as an interim step. They are currently negotiating the closure of 2½ plants in Connecticut that will impact capital equipment and 10,000 additional employees.

Monitoring overhead costs is a challenge and the F-22 SPO is currently implementing actions to track and control overhead costs. These include separating out overhead costs to improve visibility, improving the quality of cost and variance analysis, and "should cost" reviews for significant overhead cost changes. Also, overhead cost management is a separate criterion in the award fee plan for the F-22.

Question. Another area that caused need for additional funding and eventual rephasing of the program is program risk growth. At the May 1992 Cost Performance Report (CPR) the contractor identified $350 million of potential "risk" items which could eventually impact cost. (Such examples of these are (1) the weapons bay door whereby the plan was tougher than thought; (2) the ejection seat sled tests whereby the plan was inadequate; and the system/software engineering environment network whereby the task or requirement was misinterpreted.) Is funding required to solve these contractor risk items included in the estimated total EMD cost? If not, how and when will these problems be solved? At what cost?

Answer. Funding to address technical risk factors is covered in the overall funding for the program. The funding outlined for the EMD phase at the Milestone II is still adequate for the rest of EMD. The program is now moving beyond the preliminary design review and most technical issues and challenges are known. The Defense Science Board concluded the risk areas have been identified and are properly managed. In a leading edge technical program on a cost plus contract, there is always a change for cost growth; to date that challenge has been accounted for and handled within the program budget.

Question. The rephased EMD program delayed a procurement decision by 18 months. General Jaquish, when does continued delay begin to affect the performance of the F–22?

Answer. It is difficult to say exactly when such stretching out begins to damage the program. The current schedule is a careful combination of cost, risk, and events. Clearly, further delays would increase development program costs with no corresponding benefits. The Defense Science Board reviewed the F–22 program and concluded in their report that the program was well managed, and that additional delays provided no additional risk reduction. If the basis of such a delay is a funding reduction, then there will probably be some risks to the program. These would be caused by workforce reductions and resultant loss of key personnel, and in the disruption of the integrated product teams that are so critical to successful development of the F–22.

Question. In briefing slides provided the Committee, it was stated that tooling requirements for the airframe are tied to first flight. Please explain why.

Answer. The tooling is absolutely essential to produce the first EMD aircraft. The hard tooling requirement is driven by the close tolerances essential for stealth, integrated avionics, and aeronautical performance. Without this work on the first EMD aircraft, the first flight would not provide meaningful data on whether the system was meeting specifications—a key factor in determining its eventual readiness for production. In the recent rephasing, when the first EMD aircraft flight slipped, the tooling to produce that aircraft was subsequently rephased to match it.

Questions. The first flight is currently scheduled for June 1996, but major decisions on tooling for EMD aircraft are being funded in fiscal years 1994 and 1995. In fact, these two fiscal years contain the bulk of the funding required—$480 million out of $721 million. Why was the decision made to go with primarily hard tooling (vice soft tooling) for EMD aircraft?

Answer. DoD 5000 Series acquisition regulations were instituted to correct deficiencies identified in the previous Full Scale Engineering Development process. In particular, Engineering and Manufacturing Development is charged with developing both the aircraft and the means to produce it properly. In order to test an aircraft, particularly a low observable aircraft, the test article and the process to build the test article must closely match the production item. F–22 low observable technology requires very close tolerances to maintain performance. In F-22 EMD, the System Program Director is not testing a theory about what might work, he is developing a detailed design and manufacturing process to produce what we already have high confidence will work.

As a result, the tooling used to produce the EMD aircraft is part of the same tooling that will eventually produce the production aircraft. The time necessary to purchase the raw materials and produce the tools to build the aircraft is part of what leads to the first flight. Fiscal years 1994 and 1995 are when we will design and purchase the tools and materials to produce the EMD aircraft. The tooling required for the EMD manufacturing process we develop will produce only 6 to 8 aircraft per years. It will allow us to prove the F-22 can be built and that the F-22 we build will meet user requirements. The decision to invest in tooling for increased rates will be made commensurate with the decision to increase the production rate.

Question. With so much of the testing still required long after first flight, how can you be sure that these tools will not have to be redesigned and redeveloped? Wouldn't it be less costly to redesign and redevelop soft tooling?

Answer. The F-22 acquisition strategy is to design and develop both the aircraft and the manufacturing process during Engineering and Manufacturing Development (EMD) concurrently. Those manufacturing processes include tooling design. The F-22 EMD program has just successfully completed the Preliminary Design Review (PDR). Based on that successful review we believe that the design of many aircraft subsystems and production tools will be sufficiently mature in fiscal year 1994 to start ordering many of the parts and tools for the EMD aircraft.

As we stated in the response to the previous question, soft tooling is not appropriate to use in the production of the F-22 EMD aircraft due to the close tolerances required for low observability. Therefore, we have not analyzed the costs for the development of soft tooling.

Question. Critical Design Review (CDR) is currently scheduled between August and October 1994. Even if this stays on schedule, why is it necessary to expend the bulk of the tooling costs ($298 million) in fiscal year 1994 prior to this important milestone?

Answer. The ordering of aircraft parts and tooling in fiscal year 1994 is necessary in order to assemble the first and subsequent EMD aircraft on time per the current program schedule. This is a prudent commitment of funds that ensures the nine EMD test aircraft are available when needed to support the flight test schedule. The $298 million in fiscal year 1994 represents approximately 40% of the planned total expenditure for tooling in EMD and less than 16% of the planned expenditure for tooling over the entire program. We believe this is a prudent investment to meet the current schedule. The low risk of ordering some parts and tooling before the CDR is outweighed by the advantages of keeping to the current schedule and completing all the EMD flight test tasks on time and synchronized with the rest of the program.

Question. With uncertainty of OSD and Congressional decisions on tactical aircraft modernization requirements, there is no guarantee how many F-22s will be procured and when. If a timely decision is made to produce only the EMD F–22s and use the technology as roll over into a future joint aircraft, would you still recommend using primarily hard tooling in the EMD aircraft?

Answer. Yes. First, the need for hard tooling for the Engineering and Manufacturing Development (EMD) aircraft is primarily driven by the design tolerances necessary for stealth, integrated avionics, sensors, and aerodynamic flutter characteristics. Hard tooling is essential for building a consistent and robust set of test aircraft to demonstrate that the F–22 meets the user's requirements and satisfies the EMD contract.

Second, the accepted F–22 EMD strategy is to develop the manufacturing tooling in parallel with development of the aircraft. This is the implementation of concurrent engineering—demonstrating both the product (the airplane) and the manufacturing process that enables efficient and affordable production.

Therefore on the F–22 program, if only EMD was completed, the technology rollover would be both the aircraft technology and the manufacturing technology. Hard tooling would still be necessary to the completion of F–22 EMD even if no procurement was anticipated.

Question. How much of the $18 million in FY 92 for tooling has been obligated? Of the $78 million in FY 93?

Answer. For FY 92, all $18 million was obligated last year. For FY 93, $40 million has been obligated. More FY 93 funds would have been obligated, however funds were frozen by the FY 93 Congressional obligation restriction on tactical program funding. When the restriction expires in early June 1993, the Air Force plans to obligate the rest of the funds.

Question. What would be the impact on the F–22 program if the hard tooling decision was delayed until after OSD and Congress made decisions on future tactical aircraft modernization?

Answer. Delaying hard tooling decisions will severely disrupt the F–22 acquisition strategy. This strategy is to design and develop both the aircraft and the production tooling during EMD (concurrently) The F–22 EMD program has just successfully completed the Preliminary Design Review (PDR). Based on that successful review we believe that the design of many aircraft subsystems and production tools will be sufficiently mature in fiscal year 1994 to start ordering many of the parts and tools for the EMD aircraft. The ordering of aircraft parts and tooling in fiscal year 1994 is necessary in order to assemble the first and subsequent EMD aircraft on time per the current program schedule. This is a prudent commitment of funds that ensures the nine EMD test aircraft are available when needed to support the flight test schedule. If the hard tooling decisions are delayed, then the entire development program is delayed waiting for those tools necessary to build the nine EMD aircraft that support the development and test schedule. As noted by the recent Defense Science Board assessment of the F–22 development program, a delay at this point only increases program costs and does not reduce risk.

Question. What additional risk would be added to the F–22 program if a decision were made to use the soft tooling approach?

Answer. The F–22's program risk would increase substantially. The purpose of Engineering and Manufacturing Development is to design both the aircraft and the means to produce it. The F–22 acquisition strategy strongly links the design and manufacturing process. To abandon the strategy of building EMD test aircraft on hard tooling would significantly increase the Government's risks and costs in production. Use of soft tooling requires a more highly skilled workforce, and increases scrap, rework, and variability between aircraft. The use of soft tooling during EMD would necessitate the additional development and procurement of hard tooling later, just prior to the beginning of production activities. Under these circumstances, the Government would pay the cost of developing two sets of tooling, and thereby increase total program costs.

In addition, hard tooling is necessary to build the operationally representative test aircraft to fully prove out whether the aircraft design, as it would be produced, meets the user's needs. We have learned from past aircraft programs that soft tooling would not result in the fidelity of test assets necessary to do this.

Question. The F–117 program used soft tooling for the first 25 aircraft and then proceeded with hard tooling for the next 34 aircraft. Explain the difference between the F–117 and F–22 programs that justify the Air Force's decision to begin primarily with hard tooling in EMD?

Answer. The original procurement plan for the F–117A was for purchase of only one squadron of aircraft. Long-term production was not anticipated, thus soft tooling was used. A later decision increased F–117 deliveries. Hard tooling investments were made after that decision to improve producibility. The costs of hard tooling were ultimately recovered in reduced manufacturing costs for the additional aircraft.

Conversely, the F–22 program must address producibility issues early in the design phase. The F–22's combination of reduced signature, high airspeed, superior maneuverability, and integrated avionics require structural/sensor alignments, and closely controlled step and gap tolerances as the aircraft come off the assembly line that are best achieved through the use of hard tooling.

Finally, the use of hard tooling during EMD supports a change of philosophy in this phase of a weapon system's development. The DoD 5000 series regulations for Engineering and Manufacturing Development (EMD) require that both the weapon system and the manufacturing capability be developed during this phase. We need to prove both the weapon system and the manufacturing process. As we progress on design and manufacture of the aircraft, we will transition to more hard tooling until the end of EMD, when we will be doing all hard tooling. In addition, our tooling plan is consistent with the FY 91 Congressional direction on concurrent engineering practices.

Question. Has hard tooling been integrated during the EMD phase of other major Air Force aircraft programs, such as the B–1, B–2, C–17, etc.? If not, why not? If so, in what programs and what were the results?

Answer. The B–1B, B–2, and C–17 aircraft programs all integrated some level of hard tooling development and usage into their respective EMD programs. In fact, some hard tooling was required to manufacture the first flight test article for each program. Hard tooling integration during EMD by each program was a function of individual performance requirements, programmatic influences, and production rate/total quantity considerations.

The B–1B experienced a program stoppage between the "A" and "B" model designs. Where feasible, the "A" model hard tooling was used in the manufacture of the B–1B. However, some new tooling was required because of the design differences between the two aircraft and resulted in the purchase of additional tooling.

The low observables requirements for the B–2 resulted in close manufacturing tolerances (as small as .001 inches) as well as the need for repeatable results. A stable funding and design environment resulted in minimal hard tooling changes as the aircraft transitioned from EMD to production. This approach has been successful.

The C–17 started EMD with planned moderate concurrency of development and initial production to allow proofing of key tools early in production. Early development delays increased the concurrency so that design changes resulted in some tooling changes. The C–17 program also used a classic sequential design process where tooling engineering and design engineering were functionally separated.

The Air Force has planned the F–22 effort to minimize tooling changes. By utilizing integrated product development teams, the F–22 will incorporate manufacturing and integrated support personnel into the design process. This should avoid tooling changes resulting from designs that fail to consider manufacturing and supportability. The Air Force has virtually eliminated concurrency in the design process. In addition, a recent highly successful Preliminary Design Review (PDR) indicates stability in the design process. The F–22 incorporates low observables requirements that will require tight tolerances and repeatability much like the B–2. By eliminating concurrency, adopting the integrated design team approach, and committing to fully fund the EMD effort, the Air Force has taken the best management approach to ensuring minimal tooling costs.

Question. Long lead funding for four preproduction vehicles will be proposed in the fiscal year 1996 budget. With no aircraft fully assembled, first flight not accomplished, and all testing yet to be accomplished, why is it necessary to begin long lead in fiscal year 1996?

Answer. Long lead funding for preproduction verification aircraft is a fundamental part of the program. These preproduction aircraft form a critical part of the chain leading from detail design to manufacturing. The System Program Director must demonstrate the ability to manufacture a weapon system that performs as specified. Before committing to release these funds, we are required to have validated engine test information, design analysis which shows we meet the critical system characteristics, completed the Critical Design Review, a complete Air Vehicle Initial Production Readiness Review, and a complete engine initial flight readiness review. If we did not fund long lead for the PPVs until sometime later, we would need to schedule a break in the production line and lay off personnel. This would adversely impact the learning curve we are attempting to establish as we enter production. An increase in the production costs would be the result. Long lead funding is less than ten percent of the total dollars for the preproduction aircraft in this case, well below the 15 percent identified by DoD as the maximum for long lead funding proportions. This small portion of the production funding for the preproduction aircraft allows the manufacturing effort to maintain a smooth production schedule (no stops and starts), thus keeping the skilled workforce steadily employed throughout the EMD program.

Question. Other aircraft programs, such as the B–1 and B–2 continue to require R&D funding to solve deficiencies even after production aircraft have been procured. In fiscal year 1994, the C–17 R&D program is budgeted at twice what was originally envisioned to continue flight testing and correct deficiencies. General Jaquish, why do you believe that the F–22 program will be different?

Answer. The F–22 is our first application of the "concurrent engineering" approach to design. This system was described in the book "The Machine That Changed The World," about how the Japanese competed so successfully in the automobile industry. This concurrent engineering approach (do not confuse with concurrency in the program) includes design, manufacturing, and production engineers at the very beginning of design.

The Demonstration/Validation program proved that the design was feasible. It clearly showed technology was available to meet the user's requirements. We are now refining the design and manufacturing capabilities learned during the extensive risk reduction efforts of the Dem/Val phase. We are confident our design will not require inventing new technology. We have a flying avionics testbed to prove the avionics will work before that design is frozen. We flew the Dem/Val avionics in this 757 several years ago, to prove that the risky parts of the integrated avionics job could be done. That was with brassboard systems whose size would only fit in something the size of a 757. Now we will have a complete set of preproduction avionics, including the cockpit controls and displays, flying before the F–22 itself flies, to make certain that the sensors and computers all interact properly and talk to the pilot. These are only two examples of the efforts which the Defense Science Board praised as being well managed. In fact, this distinguished team of experts did not find a single area to criticize. Based on our approach, we are confident that the F–22 program will identify engineering challenges early and meet the planned flight test schedule.

Question. Will the Air Force and Congress be forced into additional R&D funding for many years in the future to correct deficiencies in the F–22 EMD aircraft?

Answer. The F–22 is a well planned acquisition program that has taken advantage of lessons learned on previous programs and has applied recommendations of the Packard Commission. The risk mitigation efforts in the Demonstration/Validation phase of the program and the deliberate pace of the Engineering and Manufacturing Development (EMD) phase are ensuring our best understanding of the necessary balance between user requirements, industrial capabilities, technological constraints, cost, and schedule. Approximately 59 months separate EMD contract award from first flight of the EMD test aircraft. This allows for the appropriate hardware component testing, systems integration, and software development which will minimize the potential of having to fix significant design flaws after the start of flight test.

The Contractor and Government are implementing the integrated product team approach using design and manufacturing personnel to ensure that the design will be producible. The EMD aircraft will be built using the hard tooling developed by these integrated product teams.

For these reasons, the Air Force does not anticipate spending significant R&D funds beyond those currently planned.

F–16 SQUADRONS

Question. The fiscal year 1994 R&D request for F–16 Squadrons is $116.9 million. Last year, it was anticipated that $213.7 million would be required in fiscal year 1994. For the record, provide to complete R&D costs and total costs for each item.

Answer. The FY 94 R&D content is the following:

Modified MMC	Develop/Integrate MMC for Blk 50.
Mid Life Update (MLU)	Develop/Integrate MMC for MLU, Improved Radar, Advanced Avionics, Digital Terrain System & Cockpit Enhancements.
Mission Support	In-house support, testing, fees for service, radar ECCM enhancements.
CAS Block 40/30	Develop/Integrate Blk 40 with Improved Data Modem, VHF Anti-Jam Radio, Missile Warning System and Night Vision Goggles.
MRF Studies	Prepare for MS 0 if required by the Bottom-Up Review.

[In millions of dollars]

Program	FY94	To complete	Total program
Modified MMC	51.0	37.1	261.4
MLU	27.3	22.4	113.7
Mission Sppt	12.3	(1)	(1)
CAS	21.9	(2)	(2)
MRF	4.4	(3)	(3)

[1] Costs are incurred only if SPO is in business. Estimates are developed annually, based upon work projected and number of FMS cases contracted for.

[2] Costs beyond FY 94 cannot be provided until after OSD and the service select a final CAS acquisition strategy this summer.

[3] TBD after Bottom Up review is complete.

The program has changed for several reasons. One was the decision to procure additional F–16s. The modification funding and the associated R&D efforts were reduced to pay for the additional aircraft procurement. In addition, the approach for close air support in the F–16 has significantly changed. The Air Force originally planned to fund a number of sophisticated close air support modifications on Block 30 aircraft to include a head-steered FLIR/helmet mounted display. Currently, the plans are to put additional modifications on existing Block 40 airplanes already equipped with FLIR (LANTIRN).

Question. Approximately, $4.4 million is requested for feasibility studies for a follow-on Multirole fighter (MRF). Why are these funds required in fiscal year 1994?

Answer. The funding in FY 1994 for MRF studies was intended to pursue a Phase 0 study effort following the proposed Milestone 0 in FY 94. A decision on development of a multirole fighter will be made at the conclusion of the OSD Bottom-Up Review. This review is considering all current inventory fighters and development efforts. The Bottom-Up Review will determine which aircraft will be pursued as a follow on to the F–16, and should be completed during the Summer of 1993. If the OSD Bottom-Up Review determines a need to pursue studies, the $4.4M will be used.

Question. When will a decision be made to pursue development of a multi-role fighter?

Answer. A decision on development of a multirole fighter will be made at the conclusion of the OSD Bottom-Up Review. This review is considering all current inventory fighters and development efforts. The Bottom Up Review will determine which aircraft will be pursued as a follow on to the F–16, and should be completed during the Summer of 1993.

Question. What actions have been taken with the Navy to ensure the multi-role fighter is a joint program?

Answer. We joined with the Navy in writing an Air Force/Navy Mission Need Statement for a common multirole aircraft. In addition, we have participated in several working group sessions and briefed senior Navy leadership on the progress of our initial multirole mission area assessments. Joint program determination will occur at Milestone I.

Question. The fiscal year 1994 request includes $27.3M for the Mid-Life Update (MLU) program. This program is to develop and integrate the Modified Modular Mission Computer (MMMC), improved radar, advanced avionics system, digital terrain system, and cockpit enhancements for our NATO allies. The MLU kit will not be used in US aircraft. What is the total estimated cost of the MLU program and what value will the United States receive from this program?

Answer. In addition to the activities listed in the question, the MLU also includes advanced identification friend/foe, improved data modem, global positioning system and microwave landing system. Total estimated cost to the USAF for MLU development is $113.7 million which represents approximately 25 percent of the total cost for the program. USAF participation supports a design-to-shelf approach for capabilities that may be procured in the future if the service decides to fund the modification of F–16As to the MLU configuration. The MMMC element of the MLU kit will be used on US Block 50 F–16s. MLU and MMMC are developed in the US and will be part of the overall coproduction agreement with the Europeans. The MLU efforts supports just under 1000 US jobs for the development and this number will double during the production phase. The potential for payback from future FMS procurements like Taiwan exists to further lower the cost to the USAF.

A final point is the FY 94 request allows us to keep our commitment to our allies to jointly develop an upgrade to the F–16 which is essential to our European partners.

Question. For the record, provide MLU costs for each system for fiscal years 1993 and 1994, costs to complete R&D, and total cost.

Answer. The Mid-Life Update (MLU) program is a total system integration effort and as such each component is not separately priced. US RDT&E costs for FY 1993 are $26.3M and FY 1994 are $27.3M. Cost to complete the MLU development program for the US is $22.4M (FY95/6). Total cost for the US portion of the R&D effort is $113.7M.

Question. Also for the record, provide MLU costs as above for each country.

Answer. MLU is an integration effort of several subsystems and are not separately costed. Listed below are the EPG costs by country for the development program as well as the planned number of aircraft involved.

	Number of aircraft	Development
EPG country:		
Belgium	50	$86.0M
Denmark	63	51.5M
The Netherlands	138	160.3M
Norway	58	56.1M

Question. Approximately $21.3 million is requested for the Close Air Support (CAS) mission of the F–16. For the record, provide by PE the funding required for fiscal year 1993 and 1994, to complete R&D, and total costs. Compare these with what was proposed last year for CAS.

Answer. Approximately $21.9 million is requested for CAS in FY 94. Funding requirements beyond FY 94 are pending resolution of issues between the Air Force and OSD on the strategy for CAS. The $21.9M supports the near-term effort for either the USAF CAS plan or the OSD preferred 1990 DAB position.

The 1990 DAB position and the FY 93 program (See table) that resulted, reflected a cold war, pre-Desert Storm concept and centered about creating a sophisticated F/A–16 hybrid supported by A–10s and unmodified F–16 Block 40 aircraft. The current USAF proposal, reflected in the FY 94 program in the table, centers around a missionized F–16 Block 40 LANTIRN-equipped aircraft supported by modified F–16 Block 30s and A–10s. The resolution of this issue is still being worked between the USAF and OSD.

In the table, PE 27133 is the F–16 program element and PE 64249 is the Night Attack program element. The funding requested in fiscal years 1993 and 1994 in millions is as follows:

CLOSE AIR SUPPORT FUNDING

	1993 R&D	1994 R&D	To complete	Total
FY93 program:				
PE 27133	145.0	145.6	109.9	400.5
PE 64249	25.1	29.8	10.1	65.0
FY94 program:				
PE 27133	14.9	21.9	64.3	101.1

CLOSE AIR SUPPORT FUNDING—Continued

	1993 R&D	1994 R&D	To complete	Total
PE 64249	4.9	20.2	0.2	25.3

F–15 SQUADRONS

Question. The fiscal year 1994 R&D request for F–15E squadrons is $91.5 million, double that anticipated last year to be requested in fiscal year 1994. Please explain why this has doubled.

Answer. The difference in the 1994 R&D request is due primarily to the addition of the APG–63 Radar R&M Upgrade (for the F–15 C/D) and revised cost estimates for Operational Flight Program (OFP) development and Flight Test. A detailed breakout of the changes is shown below:

	FY94 changes	Rationale for change
FY 1993 APB	+$42.0	
APG–63 Radar Upgrade	+29.5	Prevents Obsolescence.
Operational Flight Program	+10.9	Transferred from 3400.
Downsized Tester	9.7	Transferred to 3010.
ECCM	+8.3	Rephase of 92 funds cuts.
GPS	+3.1	Revised Cost Estimate.
Digital Mapping Sys	+2.0	Revised Cost Estimate.
Flight Test	+8.0	Revised Cost Estimate.
VHSIC CC	+0.3	Cost Overrun
Inflation Reduction	−2.9	FY 94 PB Adjustment
FY 1994 PB	91.5	

Question. Provide a detailed breakout of the $91.5 million, with to complete and total costs for each item.

Answer. The requested breakout follows:

FY94 RDT&E Program	FY 94	To complete	Total cost
Mission Support	$5.3	$25.6	$30.9
Flight Test	26.6	50.2	76.8
Avionics/Engineering:			
ECCM	8.3	10.0	18.3
Mission Support System	1.0	0.0	1.0
Inertial Nav System	0.2	0.0	0.2
GPS	3.1	2.5	5.6
VHSIC Central Computer	0.3	0.0	0.3
Std Flight Data Recorder	1.0	0.0	1.0
Digital Map System	2.0	0.0	2.0
R&D Engineering (Incl OFP)	14.2	40.9	55.1
APG–63 Radar R&M Upgrade	29.5	209.0	238.5
Total	91.5	338.2	429.7

Question. Last year $30 million was appropriated for a classified program. The committee understands that these funds will be sources for a health care and Somalia reprogramming. For the record through the appropriate channels, explain why this program is not being accomplished.

Answer. The answer to this question is Special Access Required (SAR) and will be answered through appropriate channels.

C–17 PROGRAM

Question. When do you anticipate that the Air Force will have a stable flight design aircraft?

Answer. The Air Force completed the initial configuration audit of the design on aircraft P–5 in February 1993, which identified the areas still requiring review and baselining. Nearly 100% of all engineering drawings have been released. The basic aircraft design, including all major systems and components, is stable. Testing will continue to validate the design (through January 1995 completion) and minor changes could result. There is a potential for additional engineering change orders to correct discrepancies or incorporate enhancements identified by the user during initial deployment.

Question. Explain the requirements for live fire testing (LFT).

Answer. Section 2366, U.S. Code, requires realistic survivability testing of a covered system. The FY93 Authorization Act specifies that the C–17A is a covered system, yet allows the Secretary of Defense (SecDef) to waive full-up live fire testing. The Act states that "The Secretary of Defense may exercise the waiver authority . . .", and stipulates that "If the Secretary of Defense submits a certification . . . that live-fire testing of the C–17 system under such section would be unreasonably expensive or impractical, the Secretary of Defense shall require that sufficiently large and realistic components and subsystems that could affect the survivability of the C–17 system be made available for any alternative live fire test program." The Air Force and OSD plan to request a waiver because such testing of a full C–17 would be unreasonably expensive and impractical. The waiver package will provide details on vulnerability analyses conducted to date and planned live fire testing of critical subsystems (i.e., a production-configured C–17 wing).

NOTE: FY93 language restricted the Air Force to use only FY93 funds for LFT. Relief from this FY93 language is required because actual LFT work (and corresponding funding requirements) is planned for Fiscal Years 94 and 95.

Question. For the record, provide a detailed breakout of items in the fiscal year 1994 request. Also include the cost to complete R&D and total program costs for each.

Answer. FY94 is the crucial flight test year with majority of avionics testing, cargo mission systems testing, and dedicated IOT&E. The end of FY94 will bring the program near completion of flight testing, expected in January 95. The FY94 request for $180.4M includes funds for the cost of flight test support ($70M), Engineering Change Orders ($44.1M), coverage of the limitation of government obligation (LOGO) for the Air Vehicle Contract ($40.2M), mission support ($20.9M), training costs ($3.3M), data ($1M), simulators ($.5M), and site activation at Charleston AFB ($.4M). The cost to complete RDT&E is $128.3M. A summary of the breakout follows:

[In millions of dollars]

Item	FY94	To complete
System test and evaluation	70.0	[1] 63.3
Engineering change orders	44.1	27.3
Air vehicle (LOGO)	40.2	[2] 4.2
Mission support	20.9	32.7
Training	3.3	0.5
Data	1.0	0.0
Simulators	0.5	[3] 0.0
Site Activation	0.4	0.3

[1] Test center support & live fire testing.
[2] Includes the remaining payment to ceiling on 2108 FSED contract.
[3] All C–17 RDT&E funds requested under Program Element 64231 except Simulators, which are funded in Program Element 64227.

BOMBER ROADMAP

Question. The fiscal year 1994 budget reflects a force structure of 191 bombers. Does this force structure support the Bomber Roadmap submitted to Congress last year?

Answer. Yes. The following chart indicates the near-term force structure that we are following enroute to the final force structure outlined in the Bomber Roadmap. ———.

[CLERK'S NOTE.—Classified insert removed.]

Question. Last year the funding required to support the programs in the Bomber Roadmap was estimated to be $3 billion. How do the total costs for the programs included in the fiscal year 1994 budget compare with what was envisioned in the Bomber Roadmap?

Answer. The total Bomber Roadmap programs total approximately $2.7 billion over the next 11 years.

During testimony in June 1992, the Air Force reported on Bomber Roadmap costs, with the majority being for the B–1 portion. At that time, costs were estimated to be $2.4 billion for the total program, for 11 years starting in fiscal year 1993. Today, the total B–1 program estimate is $2.5 billion. This includes the conventional upgrade enhancements to deliver CBUs, JDAM 1 and JDAM 3, and adding the MIL–STD 1760 interface, anti-jam communications, computer upgrades, GPS integration, JSOW, TSSAM and the upgrades to the defensive avionics system.

In addition, the B–52 costs in the Bomber Roadmap were estimated to be $189.2 million. Since then, better estimates have been made at about $197 million for the same programs to provide enhanced conventional capability for 47 B–52Hs.

The B–2 portion of the costs were not broken out because they were, and still are, baseline programs with the $44.4 billion program for 20 operational aircraft.

Question. The General Accounting Office state that their costs of developing and procuring precision-guided munitions, resolving B-1B operational problems, equipping the B–1B with an effective defense avionics system and providing adequate quantities of war readiness spare parts will add billions to the $3 billion estimate in last year's Bomber Roadmap. Do you agree with this assessment and why?

Answer. No. The GAO includes weapon development and procurement costs for the JDAM 1, JDAM 3, JSOW and TSSAM costs as part of their estimated for B–1 conventional upgrade costs. These precision-guided munitions programs are Joint inter-service efforts that are developing munitions that will be used on a variety of aircraft. They are not unique costs to the B–1, and therefore, are not legitimate charges to any aircraft program.

However, the Air Force agrees that $2.5 billion is required to integrate enhanced conventional weapons carriage on the B–1 and upgrade the ECM system.

Further, there are additional costs to complete the planned engine and safety modifications. These were not included in the Bomber Roadmap because we would plan for these important modifications to the aircraft regardless of its assigned nuclear or conventional role. The Roadmap was intended to show Congress the specific weapon and support programs required for all three bombers to conduct conventional operations from either the United States or forward deployed.

Question. The Air Force proposes to upgrade or modify the strategic mission B–52's, B–1's and B–2's for a tactical role. General Jaquish, what is the estimated total amount requested in the fiscal year 1994 budget for this effort?

Answer. As stated before, the B–2 costs are embedded in the $44.4 billion program to deliver 20 operational aircraft. The fiscal year 1994 budget request for B–1 and B–52H Roadmap investments is $161.8 million. The following shows the breakout by aircraft program:

[In millions of dollars]

	Amount
B–1:	
ECM risk reduction	7.2
Conventional weapons integration	88.0
Total B–1	95.2
B–52H:	
MIL–STD 1760 Interface and Heavy Store Adapter Beam installation	15.9
TSSAM integration	22.4
Have Nap Missile integration	5.0
Bomb rack conversion	4.0
Secure radios	8.1
GPS	11.2
Total B–52H	66.6
Total FY 1994 B–1 and B–52H Roadmap Programs	161.8

Question. What is the total estimated cost to complete this effort?

Answer. The Bomber Roadmap presented to Congress in June 1992, showed the cost to support and equip the B–52H, B–1 and B–2 for conventional roles. The B–2 programs are contained within the $44.4 billion baseline program. The current estimate for the B–1 costs are $2.5 billion. The B–52H costs are estimated to be $202 million. These estimates include funding for fiscal year 1993 through fiscal year 2004.

Question. For the record, provide a breakout of funds for each type bomber by fiscal year. Include the number of each type aircraft being modified to the tactical mission.

Answer.

RDT&E (3600) AND PROCUREMENT (3010)

[In millions of dollars]

Program	FY 1993	FY 1994	To complete	Total
B-1 (95 A/C):				
Unguided Wpns	10.6	14.5	16.2	41.3
JDAM 1	18.3	50.8	275.2	344.3
Radio	0.0	2.8	53.5	56.3
Computer	0.0	5.9	225.7	231.6
GPS	6.4	14.0	134.4	154.8
TSSAM	0.0	0.0	356.6	356.6
JSOW	0.0	0.0	250.8	250.8
JDAM 3	0.0	0.0	86.9	86.9
ECM	45.3	7.2	939.3	991.8
Total B-1	80.6	95.2	2,338.6	2,514.4
B-52H (47 A/C unless shown):				
MIL-STD 1760 Heavy Stores	21.0	15.9	15.3	52.2
Harpoon (19 A/C)	12.7	0.0	4.7	17.4
TSSAM	0.0	22.4	26.5	48.9
Have Nap (10 A/C)	4.3	5.0	3.9	13.2
Bomb Rack	0.0	4.0	.3	4.3
Secure Radio	7.9	8.1	1.3	17.3
GPS (95 A/C)	0.0	11.2	29.5	40.7
JDAM 1	0.0	0.0	8.0	8.0
JDAM 3	0.0	0.0	0.0	TBD
Total B-52H	45.9	66.6	89.5	202.0

B-2 BOMBER

Question. The fiscal year 1994 RDT&E budget requests $790.5 million for the B-2. Describe how these funds will be spent.

Answer. The following table depicts our plan on how the fiscal year 1994 RDT&E budget request of $790.5 million (M) will be spent.

B-2 Fiscal Year 1994 RDT&E Budget Request

	Millions
Rework (design of retrofits, changes and continued development of Engineering and Manufacturing development (EMD) aircraft)	$274.2
Flight test and data reduction	171.6
Peculiar support equipment	56.4
Engineering data and drawings	6.0
Training system development	51.1
Combined Test Force support	79.3
Lab utilization, facilities, Global Positioning Satellite (GPS), MILSTAR UHF, Tri-Service Stand Off Attack Missile (TSSAM), conventional capability, and test instrumentation	151.9

Question. Last year, it was envisioned that the fiscal year 1994 request would be $1.1 billion. What isn't being accomplished or slipped than that which was envisioned last year? If nothing, identify any savings realized.

Answer. The majority of the decrease in the fiscal year 1994 President's Budget request was due to the incorporation of the Bomber Roadmap schedule for B-2. The most significant impact to the B-2 Engineering and Manufacturing Development program was the shift of the flight test vehicles rework lay-up periods to the outyears. This new schedule projects the majority of the rework effort to occur during the fiscal year 1997 and 1998 timeframe and funding was rephased to reflect this new schedule.

Question. There are several Congressional business and technical requirements still outstanding. Describe each one. When does the Air Force anticipate that all issues will be satisfied?

Answer. There have been 58 total Congressional restrictions placed on the B-2 since 1990, 30 of which are complete. The Air Force expects completion of the remaining 28 during the summer of 1993. A detailed listing of the outstanding restrictions follows:

Remaining FY90 Congressional Requirements

BUSINESS HOOKS

Sec. 112 (b)(4): That the cost reduction initiatives established for the B-2 program can be achieved (such certification to be submitted together with details of the savings to be realized).

Sec. 112 (b)(3): That any proposed modification to the performance matrix will be provided in writing in advance to the Congressional defense committees.

Sec. 112 (b)(5): That the quality assurance practices and fiscal management controls of the prime contractor and major subcontractors associated with the B-2 program meet or exceed accepted US Govt standards.

TECHNICAL HOOKS

Sec. 112 (b)(2): That the B-2 has a high probability of being able to perform its intended mission.

Sec. 112 (b)(1): That the performance milestones for the B-2 for the previous fiscal year for both developmental test and evaluation and operational test and evaluation have been met.

Remaining FY92 Congressional Requirements

BUSINESS HOOKS

Sec. 131 (d)(1): Certification of compliance with B-2 aircraft Correction-of-Deficiency Requirements in Public Law 101-189.

Sec. 131 (d)(2): The Secretary of Defense will submit forthwith to the congressional defense committees the reports relating to Correction-of-Deficiencies clauses in B-2 aircraft procurement contracts.

Sec. 131 (e)(3): A description of the mission of the B-2 aircraft.

Sec. 131 (e)(4): An assessment by the SECDEF concerning the number of B-2 aircraft necessary for a cost-effective and operationally effective force to carry out the mission.

TECHNICAL HOOKS

SECDEF shall certify that:

Sec. 131 (c)(1): The performance milestones for FY91 have been met and that any proposed waiver or modification to the B-2 performance matrix will be provided in writing in advance to the congressional defense committees.

Sec. 131 (c)(2): No major aerodynamic or flight worthiness problems have been identified during the B-2 aircraft testing conducted before Oct 1, 1991.

Sec. 131 (c)(3): The capability to update the navigation system using the Coherent Map Mode of the B-2 radar has been successfully demonstrated.

Sec. 131 (c)(4): The basic capabilities of X and Ku band transponders have been successfully demonstrated.

Sec. 131 (c)(5): The baseline analysis of the radar cross-section signature data for AV-1 has been completed.

Sec. 131 (c)(6)(a): The test program has demonstrated sufficiently from flight testing a high degree of confidence in mission accomplishment in the area of detection and survivability.

Sec. 131 (c)(6)(b): The test program has demonstrated sufficiently from flight testing a high degree of confidence in mission accomplishment in the area of air vehicle performance.

Sec. 131 (c)(6)(c): The test program has demonstrated sufficiently from flight testing a high degree of confidence in mission accomplishment in the area of strength and durability.

Sec. 131 (c)(6)(d): The test program has demonstrated sufficiently from flight testing a high degree of confidence in mission accomplishment in the area of offensive and defensive avionics.

Sec. 131 (c)(6)(e): The test program has demonstrated sufficiently from flight testing a high degree of confidence in mission accomplishment in the area of weapon separation testing planned (as of Aug 1, 1991) to take place during fiscal year 1992.

Sec. 131 (c)(7): The original radar cross section operational performance objectives of the B-2 aircraft have been successfully demonstrated from flight testing.

Sec. 131 (e)(1): SECDEF submits a report that provides an assessment of whether the B-2 will meet its low observability (including radar cross section) requirements, including requirements which were not fulfilled in a B-2 flight test in July 1991.

Sec. 131 (e)(2): SECDEF submits a report that provides a description of any additional actions required to assure the B-2 will meet its low observability requirements, which were not planned as of July 1991.

REMAINING FY93 CONGRESSIONAL REQUIREMENTS

BUSINESS HOOKS

Sec. 151 (f): A report be submitted to Congress that describes the total acquisition costs associated with a B-2 program resulting in 20 deployable aircraft, including all cost associated with research, development, test, and evaluation and procurement (including all planned modifications and retrofits, tooling, preplanned product improvements, support equipment, interim contractor support, initial spares, any Government liability associated with termination, and other Government costs).

TECHNICAL HOOKS

Sec. 151 (d)(1)(a): Certification that the FY92 congressional restrictions are completed.

SECDEF shall provide a report dealing with the following:

Sec. 151 (e)(1): An assessment of the extent to which the B-2 will meets its original low observability (including radar cross section) operational performance objectives, including objectives which were not fulfilled in a B-2 flight test in July 1991.

Sec. 151 (e)(2): A full description of the information upon which the assessment is made, including all relevant flight test data.

Sec. 151 (e)(3): A full description of any actions planned to improve the B-2's low observability capabilities beyond the capabilities that have been demonstrated in flight testing by the date of the submission of the report and the associated costs and benefits.

Sec. 151 (e)(4): A quantitative assessment of the likelihood that a B-2 having the low observable characteristics projected for the aircraft can survive in the execution in the future of its primary mission as a penetrating nonnuclear bomber, as compared to the likelihood that a B-2 meeting all of its original radar cross section operational performance objectives contained in the current development contract can survive in the execution of such a mission.

Question. The following technical and programmatic issues are still unresolved. Please discuss the problems and specify when and how these will be resolved:

a. software deliveries;
b. aft deck temperature;
c. maintaining production deliveries; and
d. contractor versus organic support.

Answer. The following describes the status of the above items.

Software deliveries

On the critical path, but supporting the test program.

Software deliveries were late to flight test need, but corrective action resolved the difficulty. Deliveries are now on schedule to support test.

Aft deck temperatures

Aft deck problems due to higher than anticipated temperatures, solution is installation of thicker titanium deck.

Flight test of aft deck fixes scheduled for mid-January 1994.

Maintaining production deliveries

Northrop unable to maintain production schedule, overall program review established more realistic schedule.

Air Vehicle (AV) 6 delivered 9 days ahead of schedule.

AV–7 through AV–13 track close to roadmap schedule.

AVs 14–21 slightly behind roadmap, but expected to recover and deliver as projected.

Contractor versus organic support

Aircraft Depot Maintenance: Northrop will conduct the first depot maintenance, which will then evolve to organic at Tinker around calendar year 2000.

B–2 Avionics Maintenance: Interim Contractor Support first, evolving to organic at Tinker.

B–2 Hydro/mech Item Maintenance: some Interim Contractor Support, final decision expected later in 93.

Software Support: Interim Contractor Support at first, final decision expected later in 93.

The Air Force is working these issues hard and believes it has appropriate solutions in sight.

Question. General Jaquish, your statement indicates that the B–2 will be capable of penetrating and attacking the most heavily defended targets on day one with precision-guided munitions. What precision-guided munitions will be on the B–2 and when?

Answer. The current plan, as shown below, leads to full precision capability.

Weapon	B–2 Block		LOC [1]	FOC [2]
MK–84 2000 lb bomb	10	Deleted [5]	FY94	FY94
Cluster bomb Units	20	Deleted [5]	FY96	FY96
Gats [3]/GAM [4]	20	Deleted [5]	FY96	FY97
TSSAM	20	Deleted [5]	FY96	FY99
MK–82 SERIES 500 lb bomb	30	Deleted [5]	FY97	FY99
JDAM 1 with GATS)	30	Deleted [5]	FY99	FY99
JDAM 3	30	Deleted [5]	FY00	FY01

[1] Limited operational capability; one aircraft, one load.
[2] Full operational capability; 8 aircraft, one load.
[3] GPS Aided Targeting System.
[4] GPS Aided Munition.
[5] Special Access Required data.

Question. What impact will the slippage of placing the JDAM (Joint Direct Attack Munitions) on the B–2 have on the B–2 program?

Answer. The impact of the JDAM slippage on the B–2 program is a delay in a "precision" weapon capability from Block 20 to Block

30. To fill this Block 20 void, the Air Force is in the process of initiating the GPS Aided Targeting System/GPS Aided Munition (GATS/GAM) weapon program. This will provide the B–2 with a near precision capability in Block 20.

Question. The Committee understands that the Air Force was approached with a proposal to field earlier a conventional, precision bombing capability on the B–2 with the GATS/GAM (GPS Aided Targeting System/GPS Aided Munition) System. It has been suggested that this system will provide precision weapons 3½ years earlier than JDAM and would be within a small amount of the total JDAM–1 integration effort. Has the Air Force evaluated this proposal? If so, what was the outcome of this evaluation?

Answer. The Air Force has completed a preliminary evaluation of the GATS/GAM proposal. General McPeak approved proceeding with GATS/GAM using a two phased program. The first phase will test the GATS concept with a limited amount of GAM test assets to prove the concept. If successful, the Air Force will proceed with the second phase. The second phase will procure 128 GAM weapons for a B–2 near precision capability. Contract award will be in FY 95 to support weapon delivery in mid-FY 96. The Air Force will request Congressional authority to begin in 1993.

Question. What other alternative precision munitions capability has been considered by the Air Force to be installed on the B–2 in the interim? Describe the pros and cons of each.

Answer. Numerous precision weapons have been considered by the Air Force for integration on the B–2. However, each of the alternatives, with the exception of GPS Aided Targeting System/GPS Aided Munition (GATS/GAM) have been excluded for numerous reasons. The AGM–142 (Have Nap) is too large for the bomb bay without modifying the missile. The AGM–84 (Harpoon) and AGM–84E, Standoff Land Attack Missile (SLAM) requires modification of the rotary launcher assembly for weapon carriage. The family of laser guided bombs require installation of a laser target designator incompatible with B–2 stealth requirements. Television or infrared guided weapons require a weapon data link, also incompatible with stealth requirements. GATS/GAM fills the need for an interim near precision capability, since it can be provided on time, on schedule, and for a modest cost.

Question. For the record, provide a cost estimate and timetable for these alternative(s) and the GATS/GAM proposal.

Answer. The Air Force has completed a preliminary evaluation of the GATS/GAM proposal. General McPeak approved proceeding with GATS/GAM using a two-phased program. The first phase will test the GATS concept with a limited amount of GAM test assets to prove the concept. If successful, the Air Force will proceed with the second phase. The second phase will procure 128 GAM weapons for a B–2 near precision capability. Contract award will be in FY 95 to support weapon delivery in mid-FY 96. The Air Force will request Congressional authority to begin in FY 93.

If GATS is started by July 1993, a single-target capability will be available in mid-FY 96 with full multiple target capability available in mid-FY 97. Currently, the B–2 is the only weapons platform scheduled to have this capability, although the benefits of GATS could potentially provide greater accuracy to any aircraft with a

Synthetic Aperture Radar (SAR). The funding required is depicted in Figure 1. The top line is currently in the B–2 program for Joint Direct Attack Munition (JDAM) 1 integration. The second line represents what is required for the GATS/GAM program in FY 93–95 (−), and what is not needed in FY 96–97 (+), for a total of $67 million required. This funding includes full JDAM 1 integration, full GATS/GAM capability on all 20 operational aircraft, and 128 GAM weapons.

Costs for the other alternatives were not done due to the laser designator or size limitations addressed previously.

Budgeted (TY$M)	FY93	FY94	FY95	FY96	FY97	Total
B-2 JDAM 1 Funding	22	26	32	31	28	139
DELTA-GATS/GAM Program	−9	−48	−45	+10	+25	−67

Note: Includes full JDAM 1 integration.

Question. Describe the capabilities of the block 10, 20, and 30 aircraft and when will each be delivered to the fleet.

Answer. The following describes how the Air Force plans to delivery Block capability.

From its initial delivery (17 Dec. 93), the B–2 will be able to participate in any worldwide conflict.

The initial Block 10 aircraft offers a degree of survivability well beyond that of the B–1 and B–52.

The Block approach allows the crews to become proficient while the aircraft grows in capability.

	Block 10	Block 20	Block 30
First aircraft delivered to ACC	1Q FY94	3Q FY96	4Q FY97.
Worldwide capability (supportability).	CONUS to target, recover at post strike base, return CONUS via target.	Multi-ship deployment to forward location.	Full squadron deployment to forward location.
Survivability	Highly survivable, penetrate low altitude.	Highly survivable, penetrate low altitude.	Mature signature, highly survivable all altitudes.
Weapons	MK–84, B–83	CBU's GATS/GAM, TSSAM–limited B–61[1].	Mk–82's, M–117, Mk–36/62, [1]JDAM 1&3 TSSAM—Full.

[1] The Air Force is currently re-phrasing the weapons schedule to accomplish these Block changes.
The Air Force intends to certify that the B–2 will meet Block 30 capabilities.

Question. If a block 30 (fully capable) B–2 will not be in the inventory until 1997–1998, what is the urgency to complete the last five aircraft?

Answer. The urgency to complete the last five aircraft is that any delay in the program would add costs to the program. The last five aircraft are the cheapest to buy and are currently 28% to 38% complete. Prudent program management would suggest that the Air Force continue with the program plan.

From an operational perspective, the last five B–2s bring the approximate equivalent of the Desert Storm deployed F–117 fleet to bear. A total twenty B–2 aircraft fleet (16 PAA available) increased weapons carriage by 45% over a fleet of fifteen (11 PAA available), thereby increasing national combat capability significantly.

The bottomline—canceling, or delaying, the last five aircraft gives up enormous combat capability and would save only $300 million (after termination costs and settlement).

Question. Approximately $4.5 billion is unobligated to date of prior year procurement and R&D funds; $1.7 billion is proposed in fiscal year 1994; and $4.5 billion is required to complete the 20 B-2 aircraft, making a total of over $10 billion yet to be expended on the program. How much of the $10 billion could be saved if the last five aircraft were terminated and the only other funds expended were for 15 block 10 operational aircraft?

Answer. Assuming that we would not complete the last five production aircraft, not upgrade the 5 Engineering and Manufacturing Development (EMD) test aircraft, and not retrofit the 10 production aircraft beyond what is currently on the Low Rate Initial Production (LRIP) contract (i.e. 7 block 10 and 3 block 10 aircraft with the new aft deck) then a total of $1431.4 million could be saved. The specific breakout of the $1431.4 million is: $622 million savings based on reducing the B-52 fleet from 20 to 15 block 30 operational aircraft and $809.4 million saved from foregoing EMD and retrofit activity on 5 EMD and 10 production air vehicles (leaving a fleet of 15 block 10 aircraft). Based on the assumption in the question, there is essentially no good way to stop at 15 notional block 10 aircraft.

To update the figures, as of April 1993, the Air Force has $412.7 million of fiscal year 1992 and 1993 R&D funds left unobligated. All $13 million of fiscal year 1992 R&D unobligated funding will be obligated by September 1993 and all $399.7 million of fiscal year 1993 R&D unobligated funding will be obligated by January 1994. Currently, the additional R&D funding required to complete the R&D program from fiscal year 1994 to completion is $2545 million. This leaves a R&D total to be obligated of $2957.7 million. As of April 1993, the Air Force has $4430.9 million of fiscal year 1991, 1992, and 1993 aircraft production funds obligated. All $551.8 million of fiscal year 1991 aircraft production will be obligated by September 1993; all $1475.0 million of fiscal year 1992 aircraft production funding (includes $500 million of Congressional withhold funding) will be obligated by September 1994; and all $2404.1 million of fiscal year 1993 aircraft production funding (includes $1760 million of Congressional withhold funding) will be obligated by September 1995. Currently, the additional aircraft funding to complete production program from fiscal year 1994 to completion is $3718.7 million. This leaves a production total to be obligated of $8149.6 million. A total of $11107.3 million of R&D and aircraft production funding needs to be obligated prior to completing the $44.4 billion B-2 program.

It is important to understand that expending funds for only 15 notional block 10 operational aircraft will preclude completion of pending initiatives important to B-2 conventional capability. These initiatives are: Contrail Management System (CMS), Advanced Narrow Band Voice Terminal, Global Positioning System (GPS), JP8 Conversion, Milstar UHF, Low Observable Closure Plan, Disk Drive Unit, Alternate Power Source for Airborne Time Transfer Unit (ATTU), and miscellaneous modifications. In addition, the B-2 would not have an accurate or precision weapons capability. Specifically, Joint Direct Attack Munition (JDAM) I, JDAM III, and Tri-Service Stand-off Attack Missile (TSSAM) B–2 aircraft integration would not be accomplished. Lastly, any plans for starting the GPS Aided Targeting System/GPS Aided Munition (GATS/GAM) as a near-precision capability on B–2 would be stopped. Without these initiatives, the Air Force would be unable to employ the B–2 in its intended mission. The B–2 would lack capabilities necessary to be employed, in conjunction with the B–1 and B–2, to support Global Reach and Global Power.

Question. Approximately $190 million of fiscal year 1992 R&D funds have not been obligated. Since they will expire at the end of fiscal year 1993, do you envision that they will be obligated prior to the end of this fiscal year? If not, for what will they be used?

Answer. Yes, all unobligated fiscal year 1992 R&D funds will be obligated by the end of fiscal year 1993. As of April 1993, only $13 million of fiscal year 1992 R&D funds were unobligated.

Question. Approximatley $1 billion of fiscal year 1993 R&D funds still has not been obligated. Adding the additional $2.5 billion required to complete R&D on the B–2 to this $1 billion, it leaves almost $3.5 billion of R&D yet to complete. If placing the JDAM on the B–2 continues to slip, does it make sense to continue to invest an additional $3.5 billion of R&D funds in making the B–2 a conventional asset?

Answer. As of April 1993, the Air Force has $412.7 million of fiscal year 1992 and 1993 R&D funds left unobligated. All $13 million of fiscal year 1992 R&D unobligated funding will be obligated by September 1993 and all $399.7 million of fiscal year 1993 R&D unobligated funding will be obligated by January 1994. Currently, the additional funding to complete the R&D program from fiscal year 1994 to completion is $2545 million. This leaves a total to be obligated of $2957.7 million.

Yes, it does make sense to complete the B–2 $2957.7 million R&D program. The B–2 R&D comprises more than just conventional enhancements. It also includes normal Engineering and Manufacturing Development (EMD) activity such as development, test, and rework of five of the six test aircraft. The five test aircraft will complete the 20 operational aircraft program. In addition, this funding supports the development of initiatives or modifications needed to obtain a Block of 30 capability. The initiatives include: Contrail Management System (CMS), Advanced Narrow Band voice Terminal, Global Positioning system (GPS), JP8 Conversion, Milstar UHF Low Observable Closure Plan, Disk Drive Unit, Alternative Power Source for Airborne Time Transfer Unit (ATTU), and miscellaneous modifications.

In the case of JDAM, the Air Force strongly supports the need to integrate JDAM on the B–2, even if the capability is achieved later than required. The Air Force's rationale is that special precautions have been taken to preclude the government from absorbing an undue amount of risk associated with weapon system acquisition concurrency and still satisfy operational requirements. Without consideration for this risk and its associated impacts on other weapons platforms, the Air Force could find itself with limited precision weapon options in the future. Lessons learned from Desert Storm have shown that precision weapons integrated on stealth aircraft work. JDAM will provide the capability to strike hardened targets with precision accuracy under adverse weather conditions. JDAM will provide this capability for the B–2 and many other weapons platforms.

Conversely, the Air Force as recognized the need for obtaining an early near precision capability on B–2. The air Force is supporting the GPS Aided Targeting System/GPS Aided Munition (GATS/GAM) to help alleviate schedule and technical risk on JDAM and to provide an early near precision capability for only a modest investment.

Question. Since, as indicated in your statement, the B–1 will be the conventional workhorse of the bomber force and most all B–52 R&D conventional conversion has been accomplished, why is it necessary to expend an additional $5 billion (R&D and procurement) into making the 20 B–2's Block 30 (fully capable) conventional assets?

Answer. Expending additional R&D and procurement funds to bring the B–2 fleet up to Block 30 capability is necessary for the nuclear role as well as the conventional role. Block 30 capability represents the original B–2 operational capability defined at program inception, with the addition of Global Positioning System navigation capability and software changes to permit employment of near-precision and precision conventional weapons. Fielding B–2's with less than full Block 30 capability, with no plans for upgrade, will not meet the war fighter's requirements for a long range, survivable weapons delivery system that can be employed with high leverage in the early days of a conflict—at a time when the survivability of other systems may preclude their use. Lessons learned from Desert Storm tell us that precision weapons integrated on Stealth aircraft are a vital element of the Theater Commander's ability to hold at risk the entire spectrum of the enemy's warmaking potential. The B–2 Block 30 aircraft embodies stealth and precision capability, with the addition of long range, making it able to strike in-theater around the world on very short notice from CONUS bases.

B–1B BOMBER

Question. It is 14 years and $27 billion since work was first started on development of the B–1B. Now it is estimated that the program may require an additional 10 years and at least $2.5 billion to repair the myriad of problems to bring the B–1B fleet up to full conventional capability. Is that a fair assessment? Explain the advantages for committing an additional $2.5 billion to the B–1B upgrades.

Answer. No, that is not a fair assessment. The 10-year and $2.5 billion investment program does not repair the B–1—it transitions the B–1 from a highly capable 1980's nuclear bomber to a highly capable 21st century precision conventional bomber. The additional $2.5 billion investment ensures that theater commanders have precision munitions capability at the onset of the next "Desert Storm." Air power with precision weapons has been clearly demonstrated to be a most effective method of protecting the national interest. With a smaller fleet size of 20 B–2s and the B–52s in reserve for STRATCOM, the 95 B–1s will be the backbone of the conventional fleet. The additional investment reflects less than one percent of the Air Force Total Obligation Authority.

Question. Since the B–52 R&D conventional conversion is almost complete and there are plans to make the B–2 conventional, what would be the impact of not appropriating the additional $2.5B?

Answer. A delay in the planned 10 year program to improve the B–1's effectiveness for its new conventional tasking will greatly reduce our ability to respond rapidly and decisively in potential future conflicts. The small number of B–2s planned, supplemented by B–52s in a standoff role, and by B–1s as currently equipped, is not enough. The B–1 needs planned lethality and survivability improvements to increase its effectiveness as the workhorse of the conventional bomber force.

Question. What would be the capability of the B–1B if these additional funds are not appropriated?

Answer. If funds to conventionalize the B–1 were not provided, the aircraft would be limited to 84 Mk–82 500 pound bombs. This limitation would prevent the Air Force from achieving the maximum combat effectiveness of the B–1, which the Air Force has chosen as its primary long range strike aircraft.

Question. The fiscal year 1994 RDT&E request is $93.5 million. Last year, only $44.8 was proposed to be requested in fiscal year 1994. Explain the cost growth.

Answer. The increase in the RDT&E request represents the conventional bomber roadmap programs. See chart below.

(TY$M)	1993	1994	To go	Total
Conv Wpns:				
A/J Radio		2.8	5.5	8.3
GPS	6.4	14.0	45.8	66.2
Computer		5.9	70.0	75.9
JDAM 1/1760	18.3	49.1	137.2	204.6
JDAM 3			83.8	83.8
JSOW			204.3	204.3
TSSAM			304.1	304.1
CBUs	10.6	14.5	16.2	41.3
Subtotal	35.3	86.3	866.9	988.5
ECM	45.3	7.2	242.2	294.7
Total	80.6	93.5	1,109.1	1,283.2

Last year's estimate for FY94 included funding for a stand alone RWR requirement which has been deleted. Also, the FY94 estimate been further refined to incorporate conventional weapons/ECM upgrades identified in the Bomber Roadmap that were certified by DEPSECDEF as cost effective in accordance with Sec. 132 of the FY92 appropriations act.

Question. Of the fiscal year 1994 request, $86.3 million is for conventional weapons upgrades. Please describe these upgrades.

Answer. The FY94 RDT&E funding supports the start of the development, design, analysis, and studies for the following upgrades:

Mil Std 1760 Interface	Provides electrical interface for all future accurate and precision conventional weapons.

GPS Integration	Provides GPS data to accurate and precision weapons.
Anti-Jam Radio	Allows B-1 to effectively communicate as an element of a force package.
JDAM 1	Integrates accurate weapon capability.
CBU Integration	Provides GATOR, Sensor-Fuzed Weapons, and Combined Effects Munitions (anti-personnel/anti-armor).
Avionics Computer Upgrade.	Provides increased throughout and memory for smart munitions, improved systems architecture, and long-term reliability and maintainability.

Question. For the record, provide the fiscal years 1993 and 1994 and to complete costs for each of these enhancements. Also indicate when each will be incorporated into the B-1B.

Answer.

RDT&E SUMMARY

(TY$M)	1993	1994	To go	1st Install	Total
Conv Wpns:					
A/J Radio		2.8	5.5	FY98	8.3
GPS	6.4	14.0	45.8	FY98	66.2
Computer		5.9	70.0	FY99	75.9
JDAM 1/1760	18.3	49.1	137.2	FY99	204.6
JDAM 3			83.8	FY01	83.8
JSOW			204.3	FY04	204.3
TSSAM			304.1	FY04	304.1
CBUs	10.6	14.5	16.2	FY96	41.3
Subtotal:	35.3	86.3	866.9		988.5
ECM	45.3	7.2	242.2	FY00	294.7
Total	80.6	93.5	1,109.1		1,283.2

PROCUREMENT SUMMARY

(TY$M)	1993	1994	To go	Total
Conv Wpns:				
A/J Radio			48.0	48.0
GPS			88.6	88.6
Computer			155.7	155.7
JDAM 1/1760		1.7	138.0	139.7
JDAM 3			3.1	3.1
JSOW			46.5	46.5
TSSAM			52.5	52.5
CBUs				
Subtotal:	0	1.7	532.4	534.1
ECM Upgrade			697.1	697.1
Total	0	1.7	1,229.5	1,231.2

Question. What additional upgrades are envisioned in future years?

Answer. B-1 weapons capability in future years will be expanded to include integration of JDAM 3, JSOW, and TSSAM as stated in the Bomber Roadmap. The Air Force will consider other cost effective weapons as necessary to insure maximum warfighting capability for the B–1 in its role as the workhorse of the conventional bomber force.

Question. General Jaquish, in your statement you indicate that the lethality, survivability, and supportability improvements will be phased into the B–1 over the next 10 years. When will the Air Force have a fully capable B–1B in the inventory?

Answer. The B–1 is a superb aircraft today. The B–1 conventional upgrade program provides lethality, survivability, and supportability improvements, including better ECM, Cluster Bomb Unit (CBU) integration, and precision capability. The current planned capability dates for JDAM 3, JSOW, and TSSAM are under review and could change as a result of the DoD Bottom-Up Review.

Years capability is planned for:	*Weapon*
FY95–FY97	CBU
FY99–FY03	JDAM1
FY01–FY03	JDAM3
FY03–FY05	JSOW
Will follow	TSSAM

Question. Last year, $86.4 million was appropriated for the B–1B RDT&E program. Describe how these funds are to be spent.

Answer. The following chart gives the spend plan for the $86.4M appropriation.

FY93	RDT&E Project	(TY$M)
Conv Wpns:		
GPS	Development for navigation and target location data	6.4
JDAM 1/1760	Develop standard interface for precision weapons	18.3
CBUs	Develop hardware/software modifications	10.6
Subtotal		35.3
ECM	Studies and risk reduction; prepare for FY94 EMD start.	45.3
Total		80.6
	DoD reductions	5.8
Total		86.4

Question. Except for paper studies and analyses to correct the electronic countermeasures deficiency, the B–1B funds were fenced until the following report was received. What is the status of the plan showing an acquisition strategy, financial execution plan, milestone schedules, firm operation requirements, specification of needed ECM improvements, precise identification of the use of funds for fiscal year 1993 and the future, and an assessment of technology issues and risks?

Answer. The program has been presented to OUSD(A) along with the Request For Proposal (RFP) soliciting Rockwell to be the integrating contractor. The program documentation identified in FY93 Congressional language will be available after RFP approval. The current plan is to start the risk reduction planning as soon as the RFP is approved for release and a contract can be awarded. The Air Force is also planing to complete a Cost and Operational Effectiveness Analysis in preparation for a Defense Acquisition Board review scheduled for late CY94.

Question. Also what is the status of an independent assessment identifying the costs, schedule, and technical requirements for modifying at least one-half of the B–1B fleet to carry the conventional air-launches cruise missile (ALCM)?

Answer. The Department of Defense tasked the Institute for Defense Analysis (IDA) to conduct this independent analysis. There work is underway. The independent assessment should be available in July 1993.

Question. Another report required by Congress is an alternative systems to solve the ECM (defense electronic countermeasures suite) upgrade. When do you envision it will be completed by the Air Force? Reviewed by the Institute for Defense Analysis? Submitted to Congress?

Answer. The Air Force report will be delivered by IDA for review no later than June 1993. The report is expected to be briefed to Congress in September 1993.

Question. For the record, provide an detailed track of the Air Force's plans to solve the defense countermeasures problems of the B–1B.

Answer. The Air Force plans to upgrade the B–1 defense countermeasures system by first performing studies, followed by risk reduction, and then an Engineering and Manufacturing Development (EMD) program. We are completing studies of available options to meet the B–1 ECM requirements. The B–1 conventional requirements, including ECM, will be validated by the Joint Requirements Oversight Committee in May. The Air Force has selected Rockwell to perform as the integrating contractor for the B–1. For risk reduction, Rockwell will select ECM contractors who offer an affordable and capable system to meet the B–1 requirements. After this selection, risk reduction efforts will begin on candidate systems. ECM source selection for EMD will be presented to the DAB planned for in late 1994.

Question. If the above reports are not submitted timely, will the Air Force be able to accomplish the fiscal year 1993 upgrade program?

Answer. No. Total B–1 ECM risk reduction funding is $52.5 million. $45.3 million was appropriated in FY93, with $29.5 million set aside pending submission of these reports. $7.2M is requested to compete the task in FY94.

Question. How will any delay in completing the fiscal year 1993 program impact the fiscal year 1994 program?

Answer. Delays in the FY93 weapons program will affect the program office's ability to meet the planned Engineering and Manufacturing Development (EMD) and test schedules. However, in the defense system portion of the program, FY94 funding is critical to completing the ECM risk reduction efforts to keep the FY95 EMD activities on track. Delay in receipt of FY94 money would result in a schedule slip. A reduction in the funding would result in a reduction of program content.

Question. What is the unobligated and unexpended balance of the fiscal year 1993 B–1B program?

Answer. The table below details B–1 FY93 funds unobligated and unexpended through 1 May 93:

FY93 ($M) Appropriation	Total	Unobligated	Unexpended
3600 (ECM, Conv Wpns)	79.2	65.0	78.2
3010 (Def Logistics, ICS)	165.8	58.6	140.8
3010 (Modifications)	45.5	30.3	45.5

Contractual efforts had been delayed pending a complete OSD review of the program in February. USD(A) has recently authorized the Request for Proposal (RFP) release for integrating contractor to Rockwell. With planned contract award of July 93, the unobligated 3600 dollar amount will drop to approximately $33 million. The remaining balance is planned to be obligated in Nov 93.

B–52 BOMBER

Question. The fiscal year 1994 budget proposes to transfer enhanced conventional capabilities from retiring B–52Gs to the B–52Hs. What is the rationale for this proposal?

Answer. The B–52H is the newer model and contains many improvements not available in the older B–52G. The B–52H has more powerful, fuel-efficient engines, giving it a 30% increase in power over the B–52G and greater unrefueled range. The B–52H is more capable of operating from austere locations, requiring less maintenance than the B–52G. These factors make the B–52G the logical choice for retirement.

Question. Wouldn't it make more sense to retain the enhanced B–52Gs in the force and retire some of the B–52Hs?

Answer. No. We looked at this option but found it cheaper to transfer the capability from the B–52G to the B–52H than to retain the B–52G. Savings in operations and support alone pay for the B–52H modifications in less than five years.

Question. How many of the B–52Hs will be modified with the enhanced B–52G capability?

Answer. 47.

Question. Please describe the enhanced capability.

Answer. The enhanced modifications provide the B–52Hs with the conventional capability of the B–52Gs. These modifications include:

Integrated Conventional Stores Management System (ICSMS).	Enables carriage, program and launch of MIL STANDARD 1760 munitions and external heavy stores.
Global Positioning System (GPS)	Added navigational aid.
Night Vision Goggles (NVG) Cockpit Lighting.	Cockpit lights compatible with NVGs.
Bomb Rack/Universal Bomb Bay Adapter (UBBA).	Allows quick upload and download of clipin rack without removal of CSRL attachment points.
Have Nap (10 aircraft)	Precision guided standoff munition.
Harpoon (19 aircraft)	Antiship missile.
Vinson Secure Voice	Added communication capability.
Multi-Mode Radio (ARC–210)	Added communication capability.

Question. For the record, provide the fiscal years 1993 and 1994 and to complete costs for each of these enhancements. Also indicate when each will be incorporated into the B–52?

Answer. First installation for all mods is scheduled for FY95.

($M 3010)	Fiscal years—			
	1993	1994	1995–99	Total
ICSMS (1760)	21.0	15.9	15.3	52.2
GPS		11.2	33.1	44.3
NVG Cockpit Lighting	1.8	0.3	0	2.1
Bomb Rack (UBBA)[2]		4.0	0.3	4.3
Have Nap	4.3	5.0	3.9	13.2
Harpoon	[1]12.7	0	4.7	17.4
Vinson Secure Voice[2]	0.6	0.3	0.5	1.4
Multi-Mode Radio[2]	7.3	7.8	0.8	15.9

[1] Includes 3600

[2] These mods apply to all 95 B–52Hs

Question. Part of the conventional enhancement is to incorporate interface for new "smart" weapons, i.e., TSSAM/JDAM. What portion of the fiscal year 1994 funds will support this effort?

Answer. The current MIL STD 1760 "smart" weapon interface equipment will be taken out of B–52Gs and put into B–52Hs. In FY94, $15.9M will be used for MIL STD 1760 interface, and $11.2M for GPS modification transfer to the B–52H aircraft. The GPS modification allows accurate location information to be passed to the "smart" weapon.

Question. Why are there no RDT&E funds required for this interface?

Answer. B–52/MIL STD 1760 development was already done for the B–52G, and is directly transferable to the B–52H.

Question. Last year, Congress appropriated $6.7 million for the Air Force to undertake a two-year evaluation of the HAVE LITE missile systems. HAVE LITE is a light weight version of the precision air-to-surface missile, HAVE NAP. What is the status of this evaluation?

Answer. The National Defense Authorization Act authorized $15 million for "testing of the HAVE LITE precision air-to-surface missile on the B–52 bomber." Only $8.7 million was appropriated to accomplish what had been estimated as a $15 million effort to build and launch a prototype HAVE LITE from a B–52. The Air Force does not have a validated requirement for HAVE LITE missiles.

The Air Force has been evaluating an alternative proposal to use the appropriated funds toward the HAVE LITE concept. It is to develop selected HAVE LITE technology to be inserted into the last lot of HAVE NAP production missiles. These producibility improvements are expected to save enough to purchase four additional HAVE NAP missiles using the FY93 procurement funds provided by Congress.

The Air Force plans to request authority to proceed with using the FY93 HAVE LITE funds for HAVE NAP producibility improvements within the next 60 days.

ADVANCED CRUISE MISSILE—ACM

Question. The Advanced Cruise Missile program has been terminated at 460 missiles. There is $25.4 million requested in the fiscal year 1994 budget. Why is there still a need to continue RDT&E on ACM?

Answer. The remaining effort for RDT&E is to complete depot development for the guidance, sensor, and software. The Air Force has already invested approximately $100M (FY93 and prior) into organic depot capabilities. Depot capabilities are incrementally being activated as the various capabilities become available.

Question. What is the total estimated cost to complete RDT&E on ACM?

Answer. The total estimated cost to complete RDT&E on ACM from FY94 to completion is $42.3M.

Question. For the record, provide a detailed breakout of the $25.4 million and provide total costs to complete R&D and total program for each.

Answer.

Fiscal year 1994

[In millions of dollars]

RDT&E	
Depot Dev	19.4
Guidance	9.8
Sensor	5.2
Software	4.4
SPO support	4.0
OTLP test set	2.0

RDT&E: Prior, 1597.3; FY94, 25.4; to go, 16.9; total, 1639.6.

JOINT PRIMARY AIRCRAFT TRAINER SYSTEM

Question. The Joint Primary Aircraft Trainer System (JPATS) is a joint replacement pilot training aircraft for the Air Force's T–37 and Navy's T–34 aircraft. This program was originally envisioned to be a non-development item. Why has this strategy changed?

Answer. The change in the JPATS strategy was mostly in the non-developmental item label. The Services still intend to buy an existing aircraft and will missionize the aircraft after contract award to meet the Services' requirements. The alternative, developing an aircraft from scratch, is more expensive. The Department did add a Manufacturing Development phase, and will fund the missionization required after contract award with RDT&E rather than procurement funds. Otherwise, the strategy has changed very little.

Question. What is included in the fiscal year 1994 RDT&E request of $41.6 million?

Answer. The FY94 RDT&E request of $41.6M will be used to buy an airframe, engine, avionics, missionization, test, data, engineering changes, award fee, and program management.

Question. What would be the total RDT&E and procurement costs for JPATS?

Answer. Total Air Force RDT&E is $226M, through FY 2005. Total Air Force procurement is $3.6B for 417 aircraft, with the final aircraft buy in FY 2005.

ICBM LIFE EXTENSION PROGRAM

Question. The Minuteman III Life Extension Program includes the following: Rapid Execution and Combat Targeting (REACT); Guidance Replacement Program (GRP); Propulsion Replacement Program (PRP); Single Reentry Vehicle (SRV); and Dual Frequency MEECN Receiver (DFMR). For the record, provide a breakout of each program by appropriation and PE, funds requested in fiscal year 1994, and cost to complete R&D and total cost.

Answer.

[In millions of dollars]

	Prior yrs	FY 1994		To Go [1]	Total
		3600	3020		
Rapid Execution and Combat Targeting	449.70	26.15	7.55	5.65	622.54
Single Reentry Vehicle	20.80	2.00	4.90	0.00	33.00
Dual Frequency MEECN Receiver [2]	22.00	0.00	25.25	0.00	90.00
Guidance Replacement Program (Phase 1 only)	51.00	87.40	0.00	281.20	1548.90
Propulsion Replacement Program	0.00	49.94	0.00	131.60	2319.60

[1] R&D only.

[2] Funding for Minuteman launch control centers only.

Note: FY94 funds are all in PE 11213 except Single RV funds which come from PE 35145.

Question. Guidance Replacement Program (GRP): The fiscal year 1994 RDT&E request for this program is $87.4 million. Please describe this program and how the funds will be used.

Answer. The Guidance Replacement Program (GRP) replaces/upgrades the Minuteman III (NS–20) guidance set using a two-phased approach. GRP Phase 1 replaces 1960's guidance system electronics to increase supportability, maintainability, and availability. The guidance electronics components must be replaced since current electronics components continue to degrade and are projected to become unreliable as early as 1997 and unsupportable as early as 1998. GRP Phase 1 is also required to implement the flexibility to configure the missile with a single W87 (Peacekeeper) warhead and an advanced inertial measurement unit. Engineering and Manufacturing Development (EMD) contract award is planned for August 1993.

The FY 94 funds will be used to continue GRP Phase 1 EMD including hardware and software development, conduct of the Preliminary Design Review (PDR), start of engineering model fabrication and start of developmental test and evaluation.

GRP phase 2 will provide an advanced inertial measurement unit (IMU). The advanced IMU will use modern guidance technology to provide semi-dormant operations which further increases guidance system mean time between failure (MTBF), and nuclear safety—significant life cycle cost savings are expected. GRP Phase 2 will also provide Peacekeeper-like accuracy to the Minuteman III after deactivation of the Peacekeeper missiles in 2000 and serve as a hedge against unforeseen failure of the other Triad forces. There are no funds budgeted in FY 94 for GRP Phase 2 .

Question The fiscal year 1994 RDT&E request for this new start program (Propulsion Replacement Program) is $50 million. Please describe this program and how the funds will be used.

Answer. The Minuteman III Propulsion System Replacement Program will remanufacture all three solid fuel rocket motors to correct age-related degradations, maintain existing weapon system reliability, and support Minuteman III life extension, FY94 RDT&E funds will be used to: Lower life cycle costs; correct known age-related degradations; replace materials no longer available; replace environmentally banned materials; improve manufacturing processes and improve tooling design; identify materials and components for reuse; incorporate technology improvements to enhance reliability.

Question. Since the Future Years Defense Program has not yet been completed, justify why this new start (Propulsion Replacement Program) needs to begin in fiscal year 1994.

Answer. A significant technology insertion effort, prior to the start of production, is required to replace materials no longer available, identify environmentally safe materials, reduce service life costs, certify materials and manufacturing processes, and incorporate technology improvements. For this to occur, we are lead time away from the next production cycle.

Additinally, the FY94 start bridges the gap between current and 1997 production for stages 2 and 3. this will reduce schedule and cost risks associated with "new" production, preclude start-up costs and loss of expertise, and assure a manufacturing and supply base.

Following the technology insertion effort, production must begin in 1997 to replace operational rocket motors prior to age-out.

Question. Reentry Systems Launch Program (RSLP). The fiscal year 1994 RDT&E request for this program is $16.3 million. Please describe this program and how the funds will be used.

Answer. RSLP uses deactivated Minuteman II missiles for R&D launches. It directly supports START deactivation of the Minuteman II force. The funds will be used for the continued deactivation of Minuteman II's, storage and technical assistance for R&D missile launches.

Question. Last year, Congress appropriated $8.5 million for this program and fenced $2 million until the Secretary of the Air Force provides a detailed payload requirements analysis which demonstrates how only the Multiservice Launch System (MSLS) program, as opposed to other existing or planned launch vehicles, is able to meet this requirement. What is the status of the RSLP report?

Answer. The report was delivered to the respective House and Senate Appropriations Defense Subcommittees on 10 March 1993.

[CLERK'S NOTE.—End of questions submitted for the record.]

TUESDAY, MAY 4, 1993.

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES

ADVANCED RESEARCH PROJECTS AGENCY

WITNESS

DR. GARY L. DENMAN, DIRECTOR, ADVANCED RESEARCH PROJECTS AGENCY

INTRODUCTION

Mr. DICKS. The Committee will come to order. Dr. Denman, we are glad to have you here today. The Committee will hear your testimony on the Advanced Projects Research Agency RDT&E budget request in fiscal year 1994 for about $2.2 billion. ARPA has the exciting mission of performing high-risk research that has high potential payoff for the military services. ARPA also has an excellent track record of delivering high-quality innovative products. Just a few years ago, ARPA's annual budget was under $1 billion.

The Committee is pleased to welcome Dr. Gary Denman, the Director of the Advanced Research Projects Agency. Your full statement will be included in the record and you may summarize as you see fit.

SUMMARY STATEMENT OF DR. DENMAN

Dr. DENMAN. Thank you, Mr. Chairman. It is a pleasure to be here today. It is an exciting time for ARPA and I am very pleased and gratified that I am the current director of the agency.

I would like to outline briefly our plans with respect to our fiscal year 1994 program as well as specifically highlight some of our activities in the technology reinvestment project.

Mr. Aspin has outlined four challenges for the department which I am sure you have all seen and read about. These are regional conflicts, proliferation of weapons of mass destruction, the failure of reform in the Soviet Union, and the economic strengths of the United States.

I believe ARPA is well positioned to respond to these challenges and I believe our mission is sound as it exists today. This includes the development of innovative research and development programs leading to fundamental change in our military capability.

The newest emphasis in our charter is one of stimulating a national technology base that can support both military and commercial products.

Mr. DICKS. Are you encountering problems in attempting to do that?

Dr. DENMAN. Yes, I think there are a number of challenges. I will say a few words about that and be happy to answer your questions in that regard.

This new emphasis of creating technology that meets critical defense needs, while having potential in the commercial marketplace, we call it dual use, was the basis for leading to a decision to change the name of DARPA to ARPA in the past few months.

The emphasis on dual-use technology strategy is a part of a larger strategy that has been presented by Mr. Deutch and Mr. Perry in previous testimony. This is a strategy of leading integration of the U.S. defense and commercial industrial bases. Technology is part of the front end of this process and this strategy.

I think one of the most challenging jobs ARPA has taken on in recent years is the launching of a new initiative that we call the Technology Reinvestment Project, which I am sure you have heard a great deal about. This involves nearly $500 million of the fiscal year 1993 funds appropriated in the Appropriations Act for defense conversion.

We have launched this program with a multi-agency team involving Department of Commerce, DOE, the National Science Foundation and NASA. This team is working very well.

Our progress to date: (1) we have provided industry with a comprehensive information package on all these programs including various specifics with respect to award criteria in the key technology areas of interest to this group; and we have held five regional meetings with total attendance of over 5,000 people. This week and next we are finishing a number of meetings in Denver, Philadelphia, Concord, New Hampshire, Oakland, Seattle, Ann Arbor and Little Rock.

We have had enormous response to this initiative. The vast majority of the response has been positive, especially the dialogue with industry, and encouraging industry to be a key part of the definition of the program.

Proposals for these projects are due in July. The proposals will be competitively evaluated based on technical merit and business plans relative to commitment to product implementation.

We have surfaced some issues that I would like to briefly highlight. As mentioned in a previous discussion with Dr. Deutch, defense contractors may find it difficult to convert or diversify. I believe these decisions have to be led by the individual companies, that the government should not be involved in those diversification decisions.

I believe the proposals we receive in the first round will focus on those companies that are already involved in multiple markets and I believe those will enjoy the greatest success in the near term.

The issue of allocation of intellectual property rights abound as we talk to industry. I think industry is satisfied with our answers. We are taking a highly flexible approach and making those intellectual property rights a part of the negotiation of any program.

Cost sharing has been a question asked frequently. I believe the only area that we need to think through and refine for fiscal year 1994 relates to the small- and medium-sized companies. I don't believe that we should totally eliminate the requirement for cost sharing. It is key to the commitment to be in the marketplace.

However, perhaps we need to be more flexible when it comes to small business.

I would like to highlight some of our fiscal year 1994 programs and discuss them in three parts. (1) We will continue the Technology Reinvestment Initiative that I have just discussed; (2) we have a broad set of innovative technology development programs; and (3) we have a set of programs focused on military applications.

For the technology reinvestment initiative, we allocated approximately 340 million dollars in fiscal 1994 to continue this set of programs. We also intend to continue the interagency collaboration activity, which is going extremely well.

However, until we allocate the fiscal year 1993 funds to specific programs, it is very difficult for me to get highly specific on those programs to date. We certainly will provide the information you requested from Mr. Deutch and will be as specific as we possibly can.

Mr. DICKS. I would encourage you to work with our staff more. Evidently the way this was presented was not the easiest to comprehend so we need to get it in a more presentable way.

Dr. DENMAN. We have been working on that and I am sure we can reach a resolution of that. Many of our innovative technology programs are also dual use. In fact the dual use business is not a stranger to ARPA. Some of these include programs previously congressionally sponsored. I am pleased to report that these are now in our budget, including the high definition systems, flat panel displays, advanced lithography, electronic packaging and various materials initiatives. These efforts are now funded in our budget.

A large portion of our technology program is focused on information technologies which we believe are the highest leveraged technologies in terms of defense capability and are the fastest growing markets worldwide. I believe this creates a win-win situation with respect to dual use technology.

The defense needs keep us highly focused on specific aspects of information technology. Some of our key programs submitted for fiscal year 1994 include SEMATECH, electronics design activities, high performance computing, advanced networks, software engineering, and microwave/millimeter wave integrated circuits.

I would like to digress and mention MIMIC because I think it is an excellent example of how government investments in high risk technology can lead to large markets. We started in the early 1980's working on the underlying material and processes that enable this technology. In fact there was considerable controversy on whether we should make major investments in gallium arsenide as a particular material. That led to early pilot lines.

We focused initially on digital gallium arsenide. That was somewhat of a failure in the sense of not reaching the market, but we quickly shifted to microwave technology and that has become a resounding success. An example of that——

Mr. DICKS. Should we be afraid of failure?

Dr. DENMAN. Absolutely not. We receive a lot of attention on failure sometimes, more than our successes but we are not afraid of failure.

We put together what was called the Virginia Slim, which was a very small hand-held GPS receiver. They have taken that technology and associated chip sets, turned it into GPS finders for fishermen, et cetera.

They further refined the product and now we are circling it back into a new very miniaturized defense receiver. That is real win-win.

One new area that we are investing in is called MEMS, micro electrical mechanical systems. It is very small device that can be mechanically driven instead of just electronically driven.

A few weeks ago there was a good article in Business Week on this technology.

Finally, I believe the core reason we have an ARPA in the DOD is to focus on military applications, to bring fundamental change to the military capability. Some of our key investments that we are submitting is a continued emphasis on simulation technology, both for sorting out acquisition technologies as well as for training.

I believe this technology is having a profound impact particularly in the training arena in the military today and has potential for spreading to the commercial sector. We are including emphasis on space technology, particularly in light satellites, trying to develop a common bus and multispectral sensors.

War Breaker is a major initiative to provide capability to identify and attack mobile targets.

We have a risk reduction phase for the advanced short takeoff and vertical landing aircraft concept.

There is a new initiative for application of simulation in ship design and construction.

Our nuclear monitoring effort is nearing completion and will be a key factor in negotiation of a comprehensive nuclear test ban treaty, and we are extending these technologies to support our nonproliferation strategies.

We have new programs focused on ground forces in contingency warfare environments, including both light vehicles and battle management strategies.

I thank you for the opportunity to be here today. I will be happy to answer your questions.

[The prepared statement of Dr. Denman follows:]

Statement by

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Before the

SUBCOMMITTEE ON DEFENSE
HOUSE APPROPRIATIONS COMMITTEE

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Introduction

Good afternoon Mr. Chairman, members of the committee, and staff. I am pleased to appear before you, and to outline my vision of the ARPA mission in support of the Administration's evolving technology policy and the critical DoD challenges as characterized by Secretary Aspin. I will briefly describe the Administration's Technology Reinvestment Project (TRP), which is now well underway, discuss ARPA's FY94 program, and identify significant recent R&D accomplishments.

Despite the end of the cold war and the end of the Soviet Union, the world remains a dangerous place. Secretary Aspin has identified four challenges in formulating a strategy for the Defense Department and for ultimately ensuring our national security:

1. Preserving the readiness of our armed forces to ensure the ability to quickly reach and successfully confront regional threats,

2. countering the proliferation of weapons of mass destruction,

3. promoting democratic reform and managing potential failure to reform, especially in the former Soviet Union, and

4. contributing to the economic strengthening of this country.

I believe there is a crucial role for ARPA in the execution of Secretary Aspin's strategy.

When I came before this subcommittee last year, I stressed the DARPA, now ARPA, legacy and history that demonstrates our ability to move rapidly into new areas and to respond to new challenges and opportunities. I believe this flexibility will be even more important as we respond to the Secretary's strategic planning and, concurrently, face large reductions in the defense budget. The ARPA mission remains consistent with these new DoD challenges.

As the central research and development organization of the Department of Defense with a primary responsibility to maintain U.S. technological superiority over potential adversaries, ARPA pursues imaginative and innovative research and development projects having significant potential for both military and commercial (dual-use) applications. We are also chartered to support and stimulate a national technology base that serves both civilian and military purposes through technology sharing and collaboration with broad industry segments.

Basic to our mission is a focus on scientific breakthroughs and revolutionary approaches which lead to fundamental change in DoD's ability to execute national security policy. The emphasis on fundamental change is vital to all ARPA programs. I cannot overemphasize this management strategy as the key context for planning and priortizing the ARPA program. I believe it is the major factor that makes ARPA so unique in the acquisition community.

As we remain focused on meeting future military demands and creating fundamental change in the way we develop advanced military capability, we will continue to pursue dual-use technology that meets military needs and stimulates commercial product development. Central to this dual-use emphasis is the need to integrate the military and commercial technology and production base to ultimately provide affordable products to defense. Partnering with industry will encourage us to find new ways to insert new technology and new subsystems into fielded systems.

While all ARPA efforts are structured to address one of the four challenges outlined above, the fourth challenge represents a new emphasis on the critical relationship between economic security and national security and presents a major opportunity for ARPA to seek maximum national benefit from our technology investments. This is especially significant in view of the programmed major reductions in the DoD budget which will drastically reduce the number of weapons system purchases and will permit only a few new weapon system starts. In this context, we will structure many of our programs to transition through weapons system upgrade programs.

Technology Reinvestment Project

The Administration's decision to change the designation of DARPA to ARPA reflects our emphasis on dual-use technology development. This emphasis is also substantially reflected in the Defense Conversion, Reinvestment, and Transition Assistance Act of Fiscal Year 1993 and the implementation of that legislation through what we call the Technology Reinvestment Project (TRP). To achieve the goals of fundamental change, ARPA has taken lead roles in a number of major initiatives that cut across the government, including the TRP, High Performance Computing and Communications, Manufacturing, Education, and Electronics Programs. Each of these is not only pioneering new innovative technologies, but are seeking innovative approaches of transferring technology, developing a sound technology infrastructure base, and looking at policies needed for success.

In order to achieve the maximum payoff from dual-use technology investments, an interagency government team was formed by ARPA to manage the execution of the TRP. The Defense Technology Conversion Council (DTCC), chaired by ARPA, is administering the TRP in a fully collaborative, interagency effort with Department of Commerce/National

Institute of Standards and Technology (DoC/NIST), Department of Energy/Defense Projects (DOE/DP), National Science Foundation (NSF), and National Aeronautics and Space Administration (NASA). This revolutionary undertaking addresses a broad spectrum of essential industry and technology transition programs and ensures that industry is actively involved in shaping the programs. Our mission is to transition to a *growing, integrated, national industrial capability* which provides the most advanced, affordable, military systems and the most competitive commercial products. We are attempting to do two mutually supportive things simultaneously: simulate economic growth and bring defense and commercial industries closer together.

The eight statutory programs fall naturally into the three TRP activity areas: dual-use technology development, technology deployment, and manufacturing education and training. Approximately $240M will be invested in creation and development of dual-use technologies. Specific activities supported will seek to find commercial uses for existing defense technologies--so called spin-off; they will also seek to find defense uses for existing commercial technologies--so called spin-on; and they will seek out promising new dual-use technologies. Emphasis is being placed on leading edge technologies; eleven key technology investment areas have been identified in order to focus the program. We expect significant involvement in these programs from the DoD Laboratories, DOE Laboratories, and NASA.

Approximately $180M will also be invested in technology deployment activities. The emphasis will be on assisting U.S. small manufacturers and other enterprises to improve their performance. This will include the addition of more manufacturing technology extension and outreach centers, and the improvement of information flow between business, government and academia. Assistance will also be targeted at the task of identifying technology sources most suitable for the private sector, especially small firms. NIST is playing a major role in executing these programs.

Approximately $50M will be invested in our most important national resource: education. Specifically, it will be invested in manufacturing education and training. This will include support for additional Engineering Research Centers, innovative engineering curricula such as practice-oriented engineering masters degree programs, as well as activities that support vocational education and training. NSF is the key team member for these programs.

To date the TRP team has published an information and planning document known as the "red book", which addresses the eight programs specified in the law, identifies potential activities to be undertaken in a single competition, and describes the evaluation criteria for awarding activities to participants. As you know, each program has a unique focus, however three statutory requirements are common to all: all programs require competitive awards, all programs require cost sharing of at least 50 per cent, and all programs contain specific participation and organizational requirements. In May the actual TRP solicitation will be published, with proposals due in July, and initial awards beginning prior to the end of FY93.

As with any new effort, we have identified several issues need our attention:

1. The large defense contractors that are primarily military suppliers may have great difficulty converting to commercial products. The problems range from internal culture to a lack of understanding of the marketplace. While these large companies sort out their conformation strategies, we believe that we can be successful by placing emphasis on the first, second, or third tier of defense subcontractors. These companies have the culture and structure to make the conversion since many already participate in both military and commercial markets.

2. Another issue in implementation of the TRP is the allocation of intellectual property rights (technical data, copyrights, patents) and associated policies which are vital to successful commercialization. The statutory allocation of patent rights, for example, generally allows the contractor or subcontractor to obtain title to patents issued as a result of inventions made under government contract. However, the government retains a paid-up, royalty free license to practice or have the invention practiced on its behalf for governmental purposes including competitive procurement. In addition, the government retains "march-in rights" allowing it to recapture commercial rights in the invention under certain circumstances. This approach is frequently a disincentive to commercialization.

To help alleviate this problem we believe that a flexible approach can be successful through the use of agreements authority. ARPA has the legal authority to enter into "other transactions" under Section 2371 of Title 10, U.S. Code. These other transactions are not governed by the statute that controls patent rights under contracts and grants. This gives ARPA the flexibility to craft intellectual property provisions to meet the goals of a particular transaction.

3. The legislated cost sharing requirements pose real problems for some TRP participants. The rules are difficult; among the eight programs there are six different formulations for cost sharing. More consistent language and definitions for some terms would be helpful.

There appears to be inconsistency between the clear Congressional intent to involve small and medium sized businesses in these programs and the strict cost sharing requirement of at least 50 per cent. Large well-financed commercial firms may find the programs attractive, but for small firms cost sharing may mean they cannot participate at all. Establishing 50 per cent cost sharing as a goal where practicable, with lesser sharing expressly authorized to maximize small and medium sized business participation is recommended. This would enable funding agencies to work with small and medium sized businesses on a flexible basis.

FY94 Program

Our program is structured into three primary areas: (1) the continuation of the Technology Reinvestment Initiatives, (2) the continuation of the technology creation and maturation programs (Innovative Technology Development), and (3) military systems application and demonstration programs (Military Applications). In addition to the technology reinvestment initiatives, the vast majority of our innovative technology investments have commercial market potential as well as fill military needs. Demonstrative of our commitment to emphasize dual-use, we will continue to interact with non-DoD agencies, as well as increase interactions with commercial industries to develop strategies for integration of military and commercial products and processes. I am also pleased to report to you that we are providing funds in FY94 to continue several key programs the Congress has augmented over the past few years. These programs include High Definition Systems, Lithography, Electronic Packaging, and Materials. Developing manufacturing processes is our key thrust in implementing these programs.

Technology Reinvestment Initiatives

We plan to continue the programs initiated in FY93 under the Technology Reinvestment Project. In FY94 approximately $340M has been allocated to these programs. Since industry proposals for FY93 will not be received until July, it is difficult to specifically describe the key investments to be made. However, based on inputs from industry and multiple agency discussions, current plans are to continue activity in all eight FY93 statutory programs, with particular emphasis on the Defense Dual-Use Critical Technology Partnerships, Defense Advanced Manufacturing Technology Partnerships, and Regional Technology Alliances Assistance Programs. The extension and assistance type technology deployment programs will be executed in close collaboration with DoC/NIST. As with the FY93 effort, key technology investment areas will be finalized after receipt of proposals for the FY93 program. Based on current industry dialogue, assessments of military needs, and discussions with other agencies, emphasis will include information technologies including networking, materials, aeronautical, and vehicle technologies.

We plan to continue execution of the programs in collaboration with other agencies. Since these agencies, particularly DoC/NIST, have increased their budgets for these types of initiatives, collaboration between government agencies is critical. The White House, both the Office of

Science and Technology Policy (OSTP) and the National Economic Council (NEC), will provide overall leadership for this collaboration.

Innovative Technology Development

The ARPA FY94 program for investment in innovative technology development includes a major emphasis on a broad spectrum of information technologies including: semiconductor manufacturing, microwave integrated circuits, electronics design and manufacturing, high definition systems, high performance computing and software engineering. In addition, we are continuing efforts in materials and portable energy sources, and the relatively new area of microelectromechanical systems (MEMS). All of these investment areas have two factors in common: a significant potential for both military and commercial applications (dual-use) and a significant investment in manufacturing process technology accompanying the development of new devices and products. Our goal is to deliver advanced technology in military products that are also affordable products. The following paragraphs briefly discuss our plans in these areas:

INFORMATION TECHNOLOGIES

ARPA will continue to put major emphasis on a broad spectrum of technologies that support information technology in FY94. Our programs range from microelectronics, electronic packaging and displays to high performance computing, with increasing emphasis on network technology. We believe that information technology will have a pervasive impact on a wide variety of new innovative military systems and will continue to be the fastest growing commercial market. This emphasis on information technology is central to the overall ARPA strategy to create fundamental change in military capability and represents a major opportunity to maintain or capture wide leadership in the commercial market.

Semiconductor Manufacturing

To meet the future demand for affordable, advanced microelectronics we believe it is as important to develop and demonstrate semiconductor manufacturing processes as it is to advance semiconductor technology. ARPA has a substantial program in semiconductor manufacturing including continued sponsorship of the SEMATECH program and advanced lithography technology. Our program is a coordinated effort that seeks to create an environment for low-cost, flexible semiconductor manufacturing at the state-of-the art.

The *SEMATECH* program is the premiere example of ARPA's sponsorship of a true dual-use technology program through cooperative partnerships and cost sharing with industry. This partnership includes companies that supply the majority of the integrated circuits in the U.S. ARPA's FY94 efforts will focus on the manufacturing tools and methodologies needed for low cost, flexible, scalable manufacturing to meet defense and commercial needs. Currently the industry is optimized to produce single part types in large volumes. Emphasis will be on combining advances in manufacturing equipment with software innovations to enable state-of-the-art microelectronics manufacturing facilities capable of producing many part types in rapid turn around time and with reduced cost sensitivity to manufacturing volume. The resulting programmable and scalable factory system will be capable of supporting multiple technology generations with first-pass success, in a cost effective manner. This capability is vital to the creation of leading edge defense and commercial information systems.

ARPA's *Advanced Lithography* program is addressing long term developments required to establish the manufacturing capability for advanced semiconductor components for 1995 and beyond. Lithography is the key technology which has enabled the dynamic growth of the semiconductor and integrated circuit industry over the last two decades. Our program will develop capabilities for fabricating circuits with feature sizes of 0.18 - 0.1 microns. Current manufacturing utilizes 0.5 micron minimum features. Key developments being pursued include mask technology, improved alignment and overlay techniques, metrology, and systems development. Various exposure sources including x-ray, electron beam, and ion beam are being studied, and device demonstrations are being conducted to establish viability of developed systems. This research is a lynch pin in driving the advancement of the U.S. microelectronics industry and ultimately the improvement in system performance related to speed, power, weight, and reliability.

Microwave and Millimeter Wave Monolithic Integrated Circuits (MIMICs)

In contrast to digital microelectronic devices, MIMICs are solid state circuits that receive, transmit, and process analog microwave signals. These sensors can be considered the "eyes and ears" of equipment operating at microwave frequencies. MIMICs can either amplify received signals and send them to the digital processing portion of a system or transform digital information into microwave signals that are transmitted by an antenna. ARPA's MIMIC program was initiated in 1988 and has made significant strides in the development of improved gallium arsenide material and associated manufacturing, packaging, and test capabilities. The 1994 program will complete the development of fully integrated design, manufacturing, and testing capabilities that can produce a wide range of advanced microwave/millimeter wave circuits at low cost. These circuits are required for subsystems and components for both DoD and commercial systems, including smart weapons, communications, and radar.

This program is an excellent example of dual-use technology where ARPA has helped create a new industry capability. This area is at or near "ignition" in terms of a self sustaining industrial base capability to supply both military and commercial products. Today, several of these suppliers are exporting devices (not technology) to several countries.

Electronics Design and Manufacturing

ARPA's initiatives in electronics design and manufacturing are aimed at improving the design and manufacturing processes of complicated systems as well as improving performance through innovative packaging concepts.

ARPA's *Electronic Packaging and Interconnect Technology* program will result in the availability of new packaging technologies which enable electronic systems to be implemented with greater functional density, significant weight and volume reduction, and improved performance in terms of reduced power requirements and increased speed, all at lower cost and in shorter times. In addition to a sustaining military demand for high performance electronic subsystems, a huge and rapidly increasing world market in the electronic products industry demands dramatic increases in product sophistication and continually improved performance and features at little or no increased cost. ARPA has $90M budgeted for packaging activities in FY94 to focus on advancing technology, developing applications, improving accessibility, and advancing manufacturability and affordability. Initiatives in the advanced technology development area include high density interconnect substrates, conformal electronics, high speed and mixed signal technologies, and superconducting interconnects. In the application development area we are optimizing integrated circuits and system architectures to take advantage of this technology and accelerate its insertion into military and commercial applications such as high end signal processors, computing, and personal communications.

We are also developing the technology and infrastructure necessary to provide system designers with easy access to advanced packaging technologies. Specific goals in this area include one month turn around and $25,000 non recurring costs for semi-custom modules. We have an initiative underway to develop the equipment and processes necessary to produce high density electronic modules at a cost comparable to, or lower than traditional approaches. Specific goals include a substrate with $400 \text{cm}/\text{cm}^2$ interconnect density at a cost of $\$4/\text{cm}^2$. We believe we have a comprehensive electronics packaging program that will ensure an end-to-end capability to rapidly acquire electronic modules and subsystems for insertion into critical military systems and promising commercial markets.

In the *Rapid Prototyping of Application Specific Signal Processors (RASSP)* program ARPA is seeking to dramatically improve the process by which complex digital systems, particularly embedded signal processors are specified, designed, documented, manufactured, and supported. Improvements are measured in terms of product cycle time, life cycle cost and product quality along with portability, ease of use, and affordability. The domain of embedded signal processing has been chosen because of its importance to a wide variety of military and commercial applications. These include automatic target recognition, communications, adaptive signal sorting, character and voice recognition, and image processing. The program has adopted a "Model Year" methodology as a way of stressing the importance of continuous improvement, meeting short development cycles (three to 12 months), and avoiding point design solutions. A key aspect of the Model Year methodology is standardization of hardware and software interfaces. The program strategy is to develop the appropriate architectures, methodologies, and a comprehensive design environment utilizing virtual prototyping. Although the program is under ARPA sponsorship, all three military services are active participants.

In the *Manufacturing Automation and Design Engineering (MADE)* program we are developing and demonstrating key software elements for Integrated Product/Process Development (IPPD) and agile manufacturing applications for both mechanical and electrical design. The application focus is on mechanical parts and electromechanical assemblies, where today's automation environment is neither integrated nor flexible. MADE will develop advanced automated CAD/CAE software generators that will enable sharing, reuse, and merged product and process models, and ultimately pave the way for populating an interoperable tool set in the electromechanical system domain. Initial demonstrations will be conducted on assembly of infrared seeker and sensor components. MADE will also establish an open architecture and interface protocols to make it easy for new tools and services to plug in to the evolving set of services accessible over widely available networks. The technologies targeted by MADE are on the critical path to creating the IPPD and flexible/agile manufacturing processes need to achieve significant reduction in acquisition time and cost for future defense and commercial systems.

High Definition Systems (HDS)

The ARPA HDS program encompasses the development of a wide variety of technologies associated with high definition systems including displays, display processors, sensors, software, high density storage, packaging, and manufacturing. The program's overall goal is to achieve a design and manufacturing capability that can provide for and sustain the affordable use of high definition technology in DoD and commercial systems in the late 1990s and beyond. Display efforts include flat panel and head-mounted displays using active matrix liquid crystals, electroluminescence, plasma, and cold cathode technologies; projection displays using digital micro-mirrors, liquid crystals, and laser projection; as well as efforts in manufacturing and enabling technologies. Modeled after SEMATECH, a consortium of display manufacturers working in partnership with the government on display industry infrastructure is being established. The $57M FY94 ARPA HDS program is developing displays for use in aircraft, tanks and shipboard applications; graphics algorithms and scalable image processors; data compression techniques; and technology for manufacturing higher resolution, full-color displays.

High Performance Computing and Communications

The ARPA High Performance Computing (HPC) Program is now halfway through its initial five year plan and is focused on developing the full range of technologies needed for a scalable technology base of interoperating workstations, networks, and parallel computing systems with mass storage, systems software and development tools. These technologies will enable solutions to some of DoD's most difficult computational challenges while providing the foundations of an information infrastructure needed in this decade. Coupled with both the Technology Reinvestment Program and other ARPA efforts, the computing technologies being developed and demonstrated represent the best information technologies available to meet DoD and commercial needs. The program consists of three major areas plus supporting technologies: *Scalable Systems*, *Scalable Software*, and *Networking Systems*.

The HPC *Scalable Systems* area is pushing the frontiers of computer architecture, component technology, and systems technology for desktop workstations through the largest scale heterogeneous systems. The goal is to develop a modular technology base that will enable a variety of system configurations over a wide performance range. In FY94, we plan to build upon the successes of the program and extend the scalable technology base to include scalable Input/Output (I/O) channels, parallel mass storage, and innovative micro-architectures while exploring alternative scalable concepts for models of computation, algorithms, computational methods, and operating systems with real time support.

The *Scalable Software* area uses parallel systems to develop environments, languages, parallel library technology, and system software services which enable users of this new class of machine to realize their potential. The results of the parallel software investments begun in 1991 will be deployed and developed next year as the HPC software community begins to mature. HPC technology requires a new software technology base and development process. We expect to demonstrate how the same technologies used in the largest and highest performing HPC systems can be used in smaller systems including workstations and single processor desktop computers. Coupled with networking technology, users may use workstations to access scalable HPC servers connected to computational resources of progressively larger scale and higher performance. In 1994, efforts will show advanced scalable architectures which support both scalability and real time; computers with efficient operating system environments up to tens of thousands of processors; deployment of the first trusted operating systems; and demonstration of new approaches to high performance parallel libraries and languages.

ARPA's *Networking Systems* area is developing high performance, interoperable networking technologies as enablers of a worldwide ubiquitous information infrastructure. There will be a focus in FY94 on a number of important areas. First, Internet capabilities will expand to include interfaces to differing communication channels including optical, satellite, cable TV, ISDN, and wireless end user access; security services needed for reliable and survivable operation of networking infrastructures; and applications for audio/video teleconferencing services. Second, networks must push high performance by increasing the speed of the underlying networks, while exploring innovative ways of delivering "bits" to customers and understanding the limits of the network architecture. In FY94, this includes experimental gigabit testbeds, new higher level protocols for all optical transmissions, and empirically measuring the limits of network performance. Finally, we will initiate an advanced technology component for the Global Grid, which includes the development and demonstration of technologies for a global, gigabit/second optical network that connects DoD operational and intelligence centers. This program is a collaborative effort being performed with many other DoD agencies, as well as industry, and builds upon the networking and other scalable computing technologies that are emerging.

Software Engineering

In FY94 ARPA will continue to pursue a broad software engineering program that supports our information technology initiatives. Our Software Engineering program encompasses technologies in establishing software engineering practices, design and development of software engineering environments, and the development of advanced languages. As systems migrate to massively parallel and heterogenous distributed computing platforms, the design and development of software architectures, languages, and applications becomes more and more critical and complicated.

The *Software Engineering Foundations* program focuses on technology for developing and supporting high assurance software systems and on developing languages used in software systems integration. We are addressing techniques by which critical properties relating to security, safety, or function can be established with high levels of assurance in software components and systems. A principal challenge is the effective integration of high assurance techniques into software engineering tools evolving in the commercial market.

Complementing the Software Engineering Foundations program is the *Evolutionary Software Development* program. This program will develop technologies that facilitate an iterative, architecture-oriented approach to the creation and support of large scale software systems. These technologies will enable early validation and the iterative refinement of both requirements and design of software intensive applications. During FY94, a key focus will be to determine the effectiveness of prototyping technologies and domain specific software architectures on a range of applications.

As the DoD sponsor for the federally funded *Software Engineering Institute (SEI)*, ARPA will continue to manage the program. In FY94 the SEI will establish a framework for process improvement based upon their highly acclaimed software capability maturity model; extend this model to address engineering processes; and expand initial work in software metrics to include process and product metrics as a foundation for long term software productivity improvements.

In the *Software Technology for Adaptable, Reliable Systems (STARS)* program we are developing, integrating, and transitioning programs to demonstrate a process and architecture driven, domain specific, reuse-based approach to software engineering. This is now know as megaprogramming. This program has now entered the demonstration and transition phase. Three teams each consisting of a service and a prime contractor will apply the STARS megaprogramming technology on three different DoD problems.

MATERIALS AND PORTABLE ENERGY

The *Materials* program at ARPA can be grouped into two categories: structural and electronic materials. In the structural area, research in ceramics and composite materials focuses on improving cost effectiveness while at the same time advancing physical performance in terms of strength-to-weight, durability, temperature capability, and geometrical tolerances. The need to improve cost effectiveness has prompted ARPA to invest in the development of freeform manufacturing capabilities for metallic, ceramic, and composite materials. Freeform manufacturing capability can be described as the ability to transform virtual objects (e.g. CAD files) into solid objects without part specific tooling or operator intervention. In FY94 structural ceramic components will be demonstrated for high temperature structures.

ARPA's programs in electronic materials application promise to improve manufacturability, reduce size and weight, increase speeds, reduce system complexity, and at the same time lower manufacturing costs for electronic components. Central to the electronic materials program is the fabrication of high temperature superconductors (HTS) for application in multichip modules (MCMs) with superconducting interconnects. HTS interconnects will greatly enhance the performance of the entire electronic circuit by reducing power requirements, cycle time and power dissipation. Also being pursued is the ability to manufacture monolithic diamond wafers for integration in electronic components. During FY94 the program goal is to develop economical diamond substrate MCM production and develop electronic packaging design concepts for thermally limited applications.

We are developing a spectrum of portable energy sources based on advanced *batteries* and *fuel cells*. For example, we have developed an all solid-state battery which is rechargeable, has 100 times the shelf life, and several times the energy density of NiCd batteries, in addition to being safe and reliable. In FY94 we will produce prototype thin filmed batteries for law enforcement and counterdrug applications in addition to producing a prototype rechargeable battery equivalent of a military primary battery. We are also researching fuel cells which will be multifuel versatile, safe, reliable, have low acoustic and thermal signature, and have three times the efficiency of Carnot cycle devices. Many applications such as portable electronics and information technology are severely hampered and restricted by a lack of energy density. Our program will develop efficient, reliable, low signature, safe, high-energy and, high-power-density electrochemical power sources.

MICROELECTROMECHANICAL SYSTEMS (MEMS)

MEMS is a term that describes the devices and technology used to make miniature electromechanical systems. Using the same fabrication processes and materials that are used to make microelectronic devices, MEMS conveys the advantages of miniaturization, multiplicity, and integrated microelectronics to the design and construction of electromechanical devices. MEMS is a revolutionary, enabling technology with widespread applications including miniature inertial measurement units for personal navigation, mass data storage devices, miniature analytical instruments, non-invasive medical sensors, fiber-optic network switches, and distributed unattended sensors for environmental and security surveillance. The long-term goal of ARPA's MEMS program is to merge computation, sensors, actuators, and mechanical structure to change the way people and machines interact with the physical world. Short-term goals include demonstration of key processes and prototype systems using MEMS technologies and lowering the barriers to access and commercialization by developing an infrastructure to support shared, multi-user design, fabrication and testing. Advances in MEMS will reduce the cost and increase both the number and capability of smart systems for defense and civilian use.

Military Applications

ARPA has traditionally invested in programs to demonstrate the military utility of emerging technologies through an aggressive set of Advanced Technology Demonstration programs. These programs have not only provided demonstrations of technology, but also have led to fundamental change in military capability, e.g., precision guided weapons, stealth, and battlefield sensors. The FY94 program continues these investments and is closely tied to the DoD S&T Thrust Strategy. Some of our key programs are described below:

SIMULATION

Advanced Distributed Simulation (ADS), a major investment area for ARPA over the past several years, has become a pervasive tool for evaluating technology impacts, providing a military context for new concepts, as well as a highly effective tool for training from the soldier to Commander in Chief (CinC). Our FY94 program continues to demonstrate our commitment to develop and apply this technology to a number of our technology demonstration programs. The ADS demonstrations we have defined are designed to stress the envelope of simulation technologies while providing for effective transition to the user.

One of the more focused ADS programs we are pursuing is the *Army National Guard/Advanced Distributed Simulation (ARNG).* This program will revolutionize the way reserve component units and individuals are trained. Because the Reserve Components provide nearly half of the land combat power, there is a critical defense requirement to ensure the readiness of these forces. As was apparent during Desert Storm, insufficient training can preclude the deployment of these forces.

New low-cost scalable simulations and devices (individual through brigade; novice through expert), distributed communications, and advanced information processing capabilities are enabling the development of this revolutionary, next-generation representation of a robust and relevant synthetic battle space. It is expected that employment of the ARNG training system will double or even triple the number of ready forces in crisis. In addition to the actual training system development, an integral part of this effort is the development of an advanced distributed simulation *environment* that will foster breakthroughs in training methodologies and tools that exploit emerging information technologies. In the FY94 program we will outfit two experimental brigades with prototype technology based training systems connected through the Defense Simulation Internet (DSI). We will also begin development of artificial intelligence assisted individual learning systems.

The successful demonstration of this ARNG system will provide a model for the conduct of training across DoD, and in the conduct of vocational and educational training and instruction in the public domain.

SPACE TECHNOLOGY

The key issue impacting our future DoD and civil space capability, U.S. competitiveness, and world leadership position is affordability. Since 1988, at the urging of Congress, we have pursued over 50 space technology programs all specifically aimed at reducing the size, weight, power, and cost of space systems. Our early successes in quickly developing, launching, and operating ten small satellites and two new launch boosters have paved the way for proving that fundamental change is possible. A simple, common sense strategy has been conceived, applicable on a national level, to enable routine, affordable space architecture modernization. The strategic vision calls for the selective use of smaller, capable satellites, as operational adjuncts, to simultaneously permit low-cost technology insertion and backbone capability augmentation. The strategy also seeks to use small and larger common bus satellites with "bolt-on" payload interface to support a wide spectrum of missions across multiple satellite constellations. This approach may be able to save billions in life cycle costs by minimizing the high cost of customization and dramatically shortening production time. The $30M ARPA FY94 program includes several pivotal Advanced Technology Demonstrations (ATDs) involving joint participation of the Services, civil agencies and the commercial sector. The ATDs will address capability shortfalls existing today in DoD MILSATCOM and remote sensing space systems. These efforts are inherently dual-use and will directly contribute to cost breakthroughs for commercial satellite production and operation.

The centerpiece for achieving affordability gains is the *Advanced Technology Standard Satellite Bus (ATSSB)* program, ATSSB will prove that satellites can be built combining high performance with common industry standards to allow for truly bolt-on payloads. This common bus will be capable of supporting a variety of high mass fraction, operationally useful payloads in a wide range of orbits and at very low recurring cost. The *Collaboration of Advanced Multispectral Earth Observation (CAMEO)* program will demonstrate a critically needed, dual-use multispectral payload hosted on ATSSB in low earth orbit to support future DoD and civil remote sensing satellite modernization and to stimulate growth in the commercial remote sensing market. The *Advanced Satellite Technology and EHF Communications (ASTEC)* program will demonstrate advanced EHF payload technologies. The final ATD, the *MILSATCOM Terminal Technology (IMPACT)* program will demonstrate improvements in future MILSATCOM terminal affordability, interoperability and mobility, and together with ASTEC, will demonstrate the means to connect theater-based warfighters with the emerging commercial global fiber grid.

WAR BREAKER

The WAR BREAKER project goal is to develop and demonstrate technologies and systems enabling a fully integrated, end-to-end system capable of targeting and neutralizing time-critical targets within enemy strike cycle times. This is being accomplished by focusing on key ARPA high-leverage initiatives and integrating these with ongoing developments and existing systems within the services. Specifically, the WAR BREAKER goals will be achieved by exploiting ARPA's electronics and information technologies including advanced sensors, computing systems, automated intelligence correlation and processing, and distributed simulation. The project is divided into three efforts: Surveillance and Targeting, Intelligence and Planning, and Systems Engineering and Evaluation. Each effort is based on multiple demonstrations of increasing complexity and integration and contributes to the overall WAR BREAKER capability, culminating in overall system demonstrations in FY99. In FY94 we will be spending about $140M across these three areas.

The Surveillance and Targeting effort concentrates on developing and integrating technologies and systems yielding wide area and focused surveillance, target detection and recognition, and precision target acquisition capabilities. Technologies being investigated include advanced 3D and polarimetric Synthetic Aperture Radar, Multi-Spectral Electro-Optical/Infrared (EO/IR), foliage penetration technologies, internetted unattended ground sensors and robust automatic target detection and recognition algorithms.

The Intelligence and Planning effort is focusing on the development of technologies and systems to provide a continuous update of enemy force status and provide a commander the means to rapidly nominate targets of interest. Efforts are underway to develop algorithms and software for the automation of intelligence processing and data correlation, automated strike planning and decision aids, automated terrain data generation, and support of distributed dynamic databases enabling theater-wide sharing of information.

The Systems Engineering and Evaluation effort concentrates on developing the WAR BREAKER system architecture, the system integration of all WAR BREAKER elements, and evaluation of the system performance. This is being implemented using simulation, system engineering tools, and the communications infrastructure necessary to conduct rapid prototyping for concept and architecture evaluation. This distributed simulation environment will provide a method of assessing existing, as well as future system capabilities, while allowing early user participation to facilitate eventual technology transition.

ADVANCED SHORT TAKE OFF, VERTICAL LANDING (ASTOVL)

The ARPA ASTOVL/Conventional Take Off and Landing, Common Affordable Lightweight Fighter Program has two primary goals. The first goal is to demonstrate, through actual flight testing of full-scale aircraft, that a common replacement for the F-18, F-16, and AV-8 fighter/attack aircraft is feasible. The Navy and Marine Corps variant of the aircraft will include a propulsive lift system to enable operations from ships and austere airfields.

The Air Force variant will have the same airframe, avionics, and engine as the Naval version but will have the propulsive lift system removed and replaced with additional fuel capacity.

The second major goal of this program is to show that military aircraft can be made more affordable. In this program ARPA intends to explore and demonstrate that innovative design, development, manufacturing, and management techniques can be employed to dramatically reduce the cost of aircraft. Among the processes being explored are the use of inexpensive "soft" throw away tooling and the lean production techniques so successfully employed by the automobile industry. Our emphasis in FY94 is to validate critical technologies, perform manufacturability demonstrations, and mature a demonstrator aircraft design. Our commitment is only to this risk reduction phase. A commitment to a technology demonstrator will not occur until FY95 or 96.

MARITIME SYSTEMS TECHNOLOGY

ARPA's traditional support to the Navy for technologies such as signal processing and sensor development has been broadened to include a larger spectrum of technologies related to Maritime Systems. ARPA is pursuing programs that will help solve technology shortfalls and affordability issues in Maritime applications.

The *Simulation Based Design* program focus is on the potential to reduce the cost of the ship design and acquisition process through the use of simulation in all phases of a ship's life cycle; from initial concept through ship service life. Virtual prototyping will be used to produce designs that are optimized at the system level vice the traditional method of design where optimized subsystems are integrated into a whole. The overriding program goal is to reduce the cost of large, complex vehicles by reducing design time and reducing the number of design changes made from initial concept through manufacture.

Complementing the Simulation Based Design program is the *Ship Systems Automation* program. Automation technologies and distributed virtual environments to promote integrated product and process development will pave the way for quicker, affordable development of ship systems. The actual systems being pursued include both combat and platform systems which show promise in reducing manning requirements while improving ship performance.

CONTINGENCY MISSION TECHNOLOGY PROGRAMS

The emergence of regional conflicts which threaten U.S. vital interests highlight the need for a survivable U.S. force which can deploy quickly any where on the globe. ARPA's contingency mission technology programs are focused on easing deployment burdens and making U.S. forces more survivable. The centerpiece effort is the *Light Contingency Vehicle (LCV)* technology program. LCV is a technology development program for lightweight, highly deployable vehicles which will form the basis for a variety of mission variant (scout or target acquisition roles) platforms in the next century. The LCV will help protect soldiers from the most likely threats by using advanced, light weight, innovative integrated survivability measures such as signature management technologies and an advanced structure which will resist penetration by small arms fire and artillery and mine fragments. The LCV program will also feature active countermeasures to disrupt attacks by rocket propelled grenades and smart weapons.

The *Land Warrior program*, a separate ARPA Contingency Mission technology program, will seek to enhance the effectiveness of dismounted soldiers by applying advanced civilian information and communications technology. Hands-free personal communications ("spin-on" from the commercial personal communications industry) are being coupled with position location and digital assistant technology to enhance the effectiveness of dismounted soldiers for real time mission planning and situational awareness.

NUCLEAR MONITORING PROGRAM

ARPA has the primary responsibility within the Department of Defense for developing the technologies which are needed to verify a nuclear test ban treaty. Completing a verifiable treaty has been a long-standing goal of the U.S. and is supported by this Administration. ARPA is actively pursuing and demonstrating innovative technologies which will be available as the negotiations on such a treaty progress. The ARPA efforts are a key part of the administration's approach to verification of this treaty. The ARPA technologies focus on separation of background noise and detection of small explosions which could be detonated under evasive conditions. For example, our seismic array technologies have set the standard for ultra-sensitivity, and using advanced electronics we have significantly reduced the costs of these systems. The processing of data from our seismic arrays is a complex problem which we are solving by implementing advanced artificial intelligence methodologies and distributed signal processing knowledge acquisition tools.

As a key part of its responsibilities, ARPA is providing the technical support in the development and demonstration of a cooperative international monitoring system being carried out under the auspices of the Conference on Disarmament, Group of Scientific Experts. The Conference has agreed to use the ARPA-developed facilities as the prototype International Data Center in the large-scale experiments which will begin next year. While the key elements of the system have been developed and tested, additional research is required in seismic signal processing methods and signal identification techniques, as well as integration of advanced methods of radionuclide detection.

ARPA is also actively involved in developing new technologies which can contribute in innovative ways to the U.S. counter-proliferation efforts. The ARPA program goal is to provide fundamental technologies that will enhance the global surveillance of the production, testing, and storage of nuclear materials and weapons. A prototype Non-Proliferation Monitoring System is being developed which could be deployed world-wide to collect unique data on nuclear activities. By providing means of detection and verification of proliferation activity, enhanced safeguards may be developed to inhibit the spread of weapons of mass destruction.

Program Accomplishments

ARPA continues to develop and demonstrate this country's most exciting technologies; technologies that serve as the foundation for the future. The following list of recent accomplishments demonstrates ARPA's unsurpassed research and development legacy in both the defense and commercial sectors.

- MIMICs are being used in a large number of DoD systems development programs and have seen record increases in use in the commercial markets, especially in communication and automotive applications. In addition, U.S. world-wide market share is on the rise; many chip sales are being made to Japan and to European nations. Decreasing chip costs, increasing yields, and higher performance MIMICs will continue to increase demand in the world market and positively impact the U.S. market share.

- The SEMATECH program continues to make remarkable strides in advancing the manufacturing technology and the domestic infrastructure to provide U.S. semiconductor companies the capability to be world class suppliers. In the last two years we have, for the first time in over ten years, seen the U.S. semiconductor equipment manufacturers surpass the Japanese in world market share.

- In the last year the High Definition Systems program has seen numerous accomplishments. To cite just a few: Texas Instruments demonstrated the world's most complex micromechanical device using digital micromirror technology to build a 640 x 480 pixel, color, video projection display; the world's first 13-inch diagonal 6 million pixel monochrome active matrix liquid crystal display was demonstrated by Xerox; and the David Sarnoff Research Center/Sun/Texas Instruments team demonstrated video frame rates on a high-resolution (1920 x 1080 pixel) workstation.

- The National Consortium on High Performance Computing was formed by ARPA using precompetitive technology funding. It essentially forms a heterogeneous shared environment between several consortia consisting of government labs, academia, and some of the leading National Science Foundation Centers. This unique project is able to accelerate sharing of technology between the very best centers developed by the Federal program. Within DoD, the HPC Modernization Plan, managed by Director, Defense Research & Engineering (DDR&E), has decided to work with the National Consortium on HPC.

- Last year we had several exceptional and exciting accomplishments under the HPC program. Among the most notable were the demonstration of a 10 billion operation per second class scalable computing system, the prototype demonstration of scalable operating systems, compilers for programming languages with parallel extensions, and scalable libraries. These systems are now being experimentally used throughout the research communities, DoD, NASA, NSF, DOE among others.

- ARPA has invested in technology to support high performance storage systems since the 1980s. We have now seen the productization of ARPA research in this area in the Redundant Arrays of Inexpensive Disks or RAID technology. RAID technology has enabled high performance storage systems in new 2.5" and 1.8" drives. U.S. firms continue to be the world leaders in small disk technology.

- Under our Software Engineering program, we recently released a beta-test version of an open architecture object oriented database which will enable sharing of persistent objects in a distributed network. This technology supports the next generation of distributed systems.

- Our Materials program continues to make great strides in advancing the state-of-the-art. We have demonstrated low-cost particulate reinforced metal matrix composites made with high thermal conductivity and tailorable thermal expansion. Today these materials are being used for thermal management in high power density electronic packages. These same composites also have very high damping capacity which has found application in avionics chassis to reduce vibration.

- In our High Temperature Superconducting Materials program we have demonstrated high temperature superconducting interconnects in packaged microelectronic multi-chip modules (MCMs). The ability of superconductors to carry large currents allows fine-line wiring construction of the package. Cryogenic operation also improves the basic performance at room temperature, with reduced size and power consumption.

- In addition to interconnects, receiver and transmitter technology are benefitting from high temperature superconductor components, such as filters, resonators, delay lines, antenna couplers, which can be fabricated in thin-film circuitry. These are inherently low-loss, low-power, compact devices which improve performance greatly. Receivers are now being constructed which provide much greater discrimination against interfering signals, and can be fabricated on a single wafer.

- Under ARPA's supported MEMS research program microactuator operation in a variety of liquids and flow controllers appropriate for semiconductor process control was developed and demonstrated. Fluid control is a critical component in miniature analytical instruments, aerospace applications, biomedical devices and process control.

- In our Distributed Simulation program we demonstrated interoperation of multiple wargame models on a secure network between Europe, the Continental U.S., and Pacific Commands. This technical accomplishment supported two CinC exercises with participating commands remaining at their home stations. This approach allowed strategic leaders to fashion far more realistic and complex events at significantly less cost. We also successfully demonstrated man-in-the-loop simulation as a tool for acquisition streamlining. The result of this investigation has been a richer understanding of how simulation technology can foster significant changes to the acquisition process in the future.

- In the last year ARPA has realized several major accomplishments in the WAR BREAKER program: we demonstrated the first truly successful target detection algorithms to find targets in foliage; established in the Zealous Pursuit Demonstration the potential for distributed interactive simulation as a systems engineering tool for extremely complex systems; and put in place an operational prototype for automated time critical garrison monitoring at USAEUR.

- Under our maritime systems program we demonstrated at sea a semi-autonomous unmanned underwater vehicle deployed ahead of a ship to detect mines and provide sufficient warning for avoidance. This same unmanned vehicle, in an autonomous mode, demonstrated the ability to search an ocean area and locate randomly placed mines. An acoustic warfare battle management prototype and synthetic ocean prototype was demonstrated in distributed simulation using the Defense Simulation Internet. And, finally we transitioned to the Navy the Hydrodynamic/ Hydroacoustic Technology Center, which was a product of the highly successful Congressionally directed program in advanced submarine technology.

- FY93 marks the end of the ARPA-led joint program with the Army and Marine Corps on Armor Anti-Armor. This successful program has led to a number of transitions of systems and technology to the Services which hold revolutionary promise. Armor weight and space efficiencies twice that of existing deployed technology have been demonstrated. A novel survivability technology has been proven that could protect a medium weight vehicle better than a current heavy tank against some threats. Kinetic energy penetrators that work on new physical principles have been demonstrated at scale, while a rocket boosted tank round with unparalleled accuracy and effectiveness has been designed and components tested. In addition, using computer-aided design, shaped charge warheads have been developed that have the highest tip speed and best performance of any in the world.

Summary

In summary, I hope I have given you an appreciation of our continued commitment to pursue research and development projects that will keep U.S. forces technologically superior, and at the same time support U.S. economic growth. Our investment in dual-use technologies will allow us to leverage limited resources to increase the availability of critical technologies *and* make application of these technologies affordable in commercial and defense markets. As we emphasize dual-use, and implement the Technology Reinvestment Project, we will continue to interact with non-DoD Agencies and increase interactions with commercial industries to develop strategies for integration of military and commercial products and processes. This new emphasis on the critical relationship between economic security and national security presents a major opportunity for ARPA to seek maximum national benefit from our technology investments.

Thank you for the opportunity to be with you today. I am ready to answer any questions you may have.

ARPA SUCCESSES

Mr. Dicks. Dr. Denman, I appreciate very much what you are doing. I think the work at ARPA is some of the very best and has paid off tremendously. In terms of the military side of the equation, precision-guided weapons, Stealth, battlefield sensors—if you looked at what happened in Desert Storm--Desert Shield because of Iraq, some of these technologies were absolutely crucial for our gaining quick superiority and air control and allowed us to save, I think, thousands of lives and were great force multipliers. It all came out of our very advanced technology, much of which had previously been criticized.

If you've read the press over the years, every major weapon system we had was deficient in some respect. Yet when the weapons performed, they did so with tremendous results. So you are right, ARPA's military applications are at the forefront of this.

Could you give us other examples? One of the major challenges for the Committee is going to be to again explain to the House, and to the American people, why we think this is such an important program.

Dr. Denman. You have probably mentioned the highest impact ones. The Stealth technology for aircraft came out of a program that was recently declassified called HAVE BLUE which was in effect a prototype of the F-117. It doesn't look exactly the same, but essentially it provided the confidence to go forward with the 117 even before we finished the flight test of the HAVE BLUE.

We had a comprehensive program in the late seventies, early eighties called Assault Breaker that led to a lot of munitions and to some of the advanced sensors.

The Joint Stars flight sensor, the moving target indication radar that was so effective, was still in the prototyping stage when taken to the Gulf, this was also an ARPA technology demonstration program called PAVE MOVER.

Mr. Dicks. Is there any doubt that as we build down the military force, reducing the number of troops, number of divisions, number of battle groups, airwings, that the U.S. must maintain its technological superiority, in order to have a smaller, but more effective military?

Dr. Denman. I think President Clinton and Secretary Aspin have made it clear that that technological superiority remains our primary tenet of national security strategy. Our major challenge is how to keep the forces modern with a much smaller acquisition program. A key focus at ARPA today continues to shift towards working what we call affordability in the form of not only developing the latest widget, if you will, but developing the manufacturing processes that come with it. That is a major shift in the last five years in ARPA investment strategy and fortunately we have been able to do that with a growing budget. It is key, to not only have the devices and widgets but also have them affordable so we can insert them into new systems.

SEMATECH

Mr. Dicks. You heard Mr. Livingston's critique earlier of SEMATECH from a newspaper article. That has been one of the projects where we have invested a significant amount of money—I think $500 million in the first five-year phase of the program. ARPA began a new second phase with $100 million in fiscal year 1993 and requested another hundred million dollars in fiscal year 1994.

Is the criticism fair or justified, or how would you characterize the program from your perspective?

Dr. DENMAN. From my perspective I think the program has been successful. Whether it is a spectacular or modest success we can debate, but I don't think there is any question the program has been successful. People like to use the market share as the primary indicator of success or failure of the program. There is validity to that. We should also pay attention to market share of the electronic producers, those people that produce the equipment that produce the microcircuits. There has been a major turnaround in U.S. market share in that industry and that is the infrastructure that allows us to sustain without critical dependency on foreign suppliers in that industry. In fact, over 50 percent of SEMATECH to date has gone to that industry.

Mr. DICKS. Which part of industry?

Dr. DENMAN. Electronic process equipment suppliers. There is an association called Semiconductor Equipment Materials something or other. Over 50 percent of the investment of SEMATECH has gone directly to that industry to develop new process equipment for the next generation of microelectronics. Without that equipment you are not in the business. It is important not only to have access to that equipment, it is important to have the knowledge to rapidly bring new equipment on to the production line.

I think the failures, if they have occurred—and the criticism comes from some companies, particularly smaller ones that have withdrawn from SEMATECH—come from what I think is a common problem to all consortia. It is only as successful as the member companies' ability to absorb the technology. Those companies that think SEMATECH is the most successful are those with processes in place to absorb the technology, immediately bring it back inside their company, get over any hurdles of the not-invented-here problem. That has led to this process equipment. Most is being tested inside of the member company facilities.

You can go to Intel today and you can find employees of Motorola, Applied Materials, all over the industry, with an Intel visitors badge working on the process line helping burn in and understand and learn about this new equipment on the Intel line and vice versa with Motorola, et cetera. That is the real success—having a common knowledge base of how to apply this new equipment to their competitive production lines. That is the biggest payoff, I believe, of SEMATECH.

Mr. DICKS. Do we still have a strong, competitive situation among the various companies?

Dr. DENMAN. Absolutely.

Mr. DICKS. There is no antitrust issue?

Dr. DENMAN. No. What we have done, and I think this is true of any partnership, is we have stayed away from specific product designs. That is where the competition equation begins, is in product design. We are working manufacturing processes on a collaborative basis and there I believe the Justice Department and others clearly see that that is not an issue with respect to antitrust.

Mr. Dicks. SEMATECH had a list of original objectives. How well has it done in meeting its original objectives?

Dr. Denman. Well, I think, again, it depends on how you measure it. If you measure it in terms of market share, certainly market share has turned around. The critics would say that is really because there is such a downturn in the Japanese economy; that they are producing less for their own internal consumption, and since they supply most of their own microcircuits to themselves, which was the original issue that created SEMATECH, the ability to penetrate those markets, so the critics would say that turnaround was only because the Japanese have a recession in their economy.

My perspective is that the companies are well-positioned for the next generation of producing microelectronics. This is very hard to measure, very hard to quantify, but I believe that that is the case, and as the next generation comes along, we will be well-positioned to stay ahead of the market. After all, that is how the Japanese penetrated the markets. We fell behind in making some of the new products and the Japanese captured the market.

Mr. Dicks. We also wanted to make sure that we were not going to be totally reliant on the Japanese industry.

Dr. Denman. Yes. There was a serious concern, not just in ability to supply today's circuits that we put into a weapon, but to have an infrastructure within our industry that knows how to design the next generation of products. If you don't have the industry producing them, there is no way you can have the design capability; therefore you would not only be dependent on products, you would be dependent on design capability, and I think we all find that unacceptable.

Mr. Dicks. What is your strategy for a new phase of the SEMATECH initiative?

Dr. Denman. We have, in fact, significantly changed both the business strategy as well as some of the technical strategies. With regard to the business strategy changes, the first five years there was a commitment from the Congress and the department to sustain an investment over a five-year period of $100 million a year by each party. What we have done for the next years, and I haven't put a time on it specifically, is one of investing in specific projects at SEMATECH.

Where we want to do advanced processing such as flexible tools and new etching processes, et cetera, SEMATECH is an excellent place to implement those programs, because we reach all of the key suppliers to the Defense Department as well as the key commercial producers. Therefore doing those kind of programs in a partnership is a much better way to execute the program. We are doing it on a project basis where we sit down and buy into specific projects with SEMATECH as opposed to any view that it might look like an entitlement program. We are doing it on a project-by-project basis. And SEMATECH management and the member companies are comfortable with that.

The primary new technical approach is one that really stems from another ARPA investment in a partnership with Texas Instruments and a few other companies to develop a highly flexible approach to microelectronics manufacturing. The next generation of microelectronic plants for high volume production is estimated to come in at about $1 billion for the plant, which has a life expectancy of three or four years. If we can change the relationship between cost and volume of product we believe you can bring on plants at a lot lower initial capital cost and therefore be more competitive in the marketplace.

The flexible cluster tool approach to production is a key strategy we are moving forward with in SEMATECH.

Mr. DICKS. Mr. Young.

NAME CHANGE

Mr. YOUNG. Thank you, Mr. Chairman. Dr. Denman, as one who has always been a supporter and usually amazed at some of the things DARPA was doing, why did you drop the D?

Dr. DENMAN. ARPA is the original name of the agency. In 1958 when it was formed it was called ARPA and in 1972 it was changed to DARPA. At that time that change was done for symmetry purposes, as I was told. I guess that means bureaucratic reasons. But it was changed now for an explicit reason, to send a clear message of emphasis and commitment to working dual use technology. We certainly still report to DOD and our number one focus at ARPA will always remain trying to cause fundamental change in military capability. We will not lose sight of that.

V/STOL AIRCRAFT

Mr. YOUNG. One of the projects I would like to ask you about—I think it is a $250 million program—is the advanced short take off and vertical landing aircraft that would perhaps be a replacement for the F–14 mission, the F–16 mission, the F–18 mission and the AV–8B. Are we making progress?

Dr. DENMAN. We have just awarded a risk reduction phase to the overall program. We have not made a commitment to build an actual flying demonstrator, but rather to work on the key technologies that will permit such an aircraft to be built. The underpinnings of it all are the enormous advances in turbine engine technology.

Compared to when the AV–8B was designed and built, engine technology has really leaped forward. If you project only about a 20-percent growth to the F–22 engine, the F–119, you can get at that point a very exciting capability in terms of performance of an aircraft with a short takeoff and a vertical landing. So it is the engine technology that begins it. The key to the vertical landing capability is to have an auxiliary lift capability either through a gas-driven fan or a shaft-driven fan. That is the number one focus of the current phase of the initiative.

One other dimension, I believe it presents an opportunity—the reason the Navy and Marine Corps are interested is because it opens up a lot of deck space for our naval arm and marine arm of aviation. But it does present for the first time perhaps an opportunity for the services to truly build essentially a common airframe. We have always had the problem of a hard carrier landing for a fighter aircraft requires a structure that is dead weight for an Air Force aircraft. Since the old FSX that has been the unsolved problem. We are taking away the hard landing on a carrier, so we believe that that is an opportunity that we should not let pass and we are continuing to push that, but we have to do some risk reduction before we say let's go build a demonstrator.

Mr. YOUNG. Is the Air Force cooperating in this project? Are they supportive of what you are doing and are they financially supporting it?

Dr. DENMAN. No. The only outside financial support at this time is a small amount from the Navy. This program is being done in cooperation with the UK and we are negotiating with them to share the cost of the risk reduction phase of this program, which is rather impressive in terms of cooperation. So no, the Air Force is not providing resources. It is fundamentally an ARPA program, but the Air Force is certainly cooperating in terms of providing people.

I believe before too long we will have an Air Force officer assigned as the deputy program manager. We currently have a Marine Corps officer. I have had long conversations with General Loh. I would say the Air Force at this time is not making any commitment to production——

Mr. YOUNG. We are not at a point where any of us could make that commitment, are we?

Dr. DENMAN. No. This is a high risk. So was the HAVE BLUE program.

MINE WARFARE

Mr. YOUNG. Looking at programs such as the A/X program for the Navy, we know what high risk projects are. One of the deficiencies, when we went to war in Desert Storm we took a lot of good tools, and most worked very well. We had a real deficiency and one of them was in mine counter warfare. Are you doing anything at ARPA to create some new technologies or new approaches to mine detection or mine clearing or anything to allow our Navy and our ships to move more freely in a mined area?

Dr. DENMAN. Yes. In the naval mine environment we have refocused quite a bit of what we used to call acoustic warfare or ASW technology into shallow water, including mine detection activities coupled with undersea, unmanned vehicle activities for countermine activities. That is a very challenging problem, to discriminate in a littoral or shallow water environment, bottom reflections off of rocks or even junk that might be in a beach area, and discriminate that from a mine. It is a challenging problem.

Fortunately, it is built on one of our stronger suits at ARPA, signal processing technologies, extracting those signals from all the clutter and noise of that environment. We are not doing a great deal in the land mine area, although we have a couple of ideas for mine clearing. The Army has a fairly aggressive program there so we have essentially deferred to the Army in that arena.

X–ROD

Mr. YOUNG. Let me ask you about one of the programs the Army feels they need, the X–ROD program, the anti-armor increased lethality initiative. We are cutting back that program, I understand.

Dr. DENMAN. Yes.

Mr. YOUNG. The Army being the sponsor seems to be supportive of the program, but I understand the Marine Corps would also like to see that program come on. What is happening there?

Dr. DENMAN. The Army has made a decision to pursue the purchase of a weapon called STAFF which, while it is not near the same concept, it performs the same mission as an X–ROD would do. X–ROD is a kinetic kill guide to hit weapon. So we face a situation where we see no path in the near term to implementation of the X–RODs. We plan to do the principal demonstration, make sure we finish that part, and then watch the STAFF program and see whether in fact it can move forward successfully. If not, I think we can quickly restart an X–ROD concept because we are going to carry it through to approve of principal demonstration of guide to hit.

Mr. YOUNG. Could you for the record provide more information on the STAFF program?

[The information follows:]

The Smart Target Activated Fire and Forget (STAFF) program is a tank-fired, fly over, shoot-down munition with a millimeter wave sensor and an explosively formed projectile warhead. It is an Army program in the final stages of development prior to production. Alliant Techsystems is the prime contractor. Additional information may be obtained from the Army Project Manager at (703) 697–0094.

Mr. YOUNG. I have other questions but will submit them for the record and Mr. Livingston has several questions that he would like to have submitted.

Mr. DICKS. Without objection.

[CLERK'S NOTE.—Questions submitted by Mr. Young and the answers thereto follow:]

NUCLEAR NON-PROLIFERATION TECHNOLOGY

Question. In FY 1993, the Congress provided a $15 million addition to the ARPA Strategic Technologies program for a new start in nuclear non-proliferation technology development.

a. What is the status of those funds?

b. Is there any assurance that the program initiated last year will be continued in FY 1994?

c. Are there technological opportunities that ARPA should be pursuing that would enhance our capabilities to deal with the nuclear proliferation problem that are not included in the current budget?

Answer. a. The goal of the proposed ARPA program formulated in response to the FY 1993 congressional initiative is to pursue those critical technologies which enhance the global surveillance of the production, testing, and storage of nuclear materials and weapons. Projects in the following three areas have been selected and funded: Detection and identification of the production of nuclear materials; detection and identification of the first test of potential proliferating countries (mid-East and North Korea); development and demonstration of the components of a global non-proliferation monitoring system. Also included in this program is support for technologies that enables a more thorough and efficient analysis of samples returned from on-site inspections. Another effort in this program is to determine what technologies and data applicable for global nonproliferation monitoring would be available in laboratories of the Russian military and weapons development facilities. The components of this program are being carefully coordinated with both the intelligence community and the Department of Energy laboratories. Research groups receiving funding under this program include universities, innovative high-technology industrial firms and federal laboratories.

b. The program initiated in FY 1993 can be continued at a reduced level in FY 1994 with the current funding request.

c. Secretary Aspin has identified the spread of weapons of mass destruction as one of the four main dangers facing the U.S. security environment. He stated that countering this threat would require new and innovative approaches on a wide variety of fronts, including intelligence and analytical capabilities. As with many technology areas, there are considerably more good ideas than we have funds to support.

Question. In light of the President's initiative to negotiate a Comprehensive Test Ban Treaty,

a. Is ARPA doing everything necessary to have the proper verification of the treaty when it is negotiated?

b. Are there gaps that need to be filled in preparing for verification of this treaty in addition to the work delineated in the FY 1994 budget?

Answer. a. Completing a verifiable Comprehensive Test Ban Treaty is being actively supported by the President and the ARPA efforts are a key part of the Administration's approach toward achieving this goal. ARPA has participated fully in the reviews directed by the President this year in preparation for negotiations of a Comprehensive Test Ban Treaty. These reviews have identified gaps in the verification capabilities that will be required under this treaty. Increased efforts are needed to develop the analytical tools to: process automatically the large number of monitored events and to identify these events as to natural or nuclear origin; integrate the information from seismic, hydroacoustic, radiochemical, and other sensors into a coherent verification system; and demonstrate a full-scale prototype of an international monitoring system for use by the treaty negotiators in setting the terms of operation of such a system. Required timing of these investments is under review.

b. ARPA, working in cooperation with the Air Force Technical Applications Center, has prepared a "Comprehensive Test Ban Treaty Verification Readiness Program" to demonstrate the capability for the U.S. to monitor a global Comprehensive Test Ban Treaty by the Congressionally-mandated 1996 date. If this program is begun immediately, these capabilities can be demonstrated as part of the negotiations of the treaty and the results will be available for incorporation into the treaty terms. The program features a cooperative international monitoring system being developed under the auspices of the United Nations Conference on Disarmament. Major parts of the envisioned system have already been developed and tested by ARPA and the Conference. The key elements of the plan have the support and backing of the international community. The data collection effort will rely on ultra-sensitive seismic arrays, supplemented by hydroacoustic sensors and atmospheric monitors, such as gas and particulate sampling. The plan will also provide significantly increased monitoring capability of the Non-Proliferation treaty.

[CLERK'S NOTE.—End of questions submitted by Mr. Young. Questions submitted by Mr. Livingston and the answers thereto follow:]

SPACE NUCLEAR THERMAL PROPULSION PROGRAM

Question. No one seems to want this program. I think it is very important because it has several technology spinoffs, dual use, commercial/government applications, etc., that we should not be terminating.

Answer. The ARPA space program personnel were briefed several years ago on the Space Nuclear Thermal Propulsion Program. At that time the program was being conducted by the Strategic Defense Initiative Organization (now the Ballistic Missile Defense Organization), and ARPA had an opportunity to co-sponsor the effort under our Advanced Space Technology Program. After review of the effort, it was determined that the program was not consistent with the strategic thrusts of the ARPA space effort, and ARPA funds were not committed to that program. This conclusion is still valid today. In addition, we believe that other Defense Agencies or organizations, such as the Defense Nuclear Agency, may be more suitable to conduct such as effort should it be approved by the Department as a continuing program. Although space nuclear propulsion may have promise for future space missions such as interplanetary expeditions, it is our understanding that this technology area does not have high priority for defense requirements today.

Question. Could this program fit in with your Space Technology Efforts?

Answer. I do not believe that the Space Nuclear Thermal Propulsion Program is consistent with the strategic plan of ARPA's Advanced Space Technology Program.

[CLERK'S NOTE.—End of questions submitted by Mr. Livingston.]

Mr. DICKS. Mr. Sabo.

Mr. SABO. I also have questions for the record.

HIGH PERFORMANCE COMPUTING

I am curious over what is happening with your high performance computer modernization plan. My concern relates to the fact that for the last two years Congress has appropriated money for procurement, and we specifically appropriated the money under the procurement account for high performance super computers. My understanding is that now half of that money is being used for experimental computers rather than operational computers.

Why is that happening? I know you have a formal modernization plan now, but the funds we appropriated in 1992 and 1993, were approved in advance of any funds being requested for that specific program.

Dr. Denman. Yes. First of all, the Computer Modernization Program is managed by OSD specifically by the DDR&E. ARPA is a participant on the team that prepared the plan. We supplied the individual that chaired the group that wrote the individual plan and the same individual participated on the team that developed the specific implementation plan. So I am not directly responsible. I don't mean to push off or anything, because I was certainly involved, and had many conversations with Dr. Reis at DDR&E, including within the overall management team where he involved all the services, sometimes called the breakfast club because we meet at an incredibly early hour of the morning. So I am aware of how this unfolded and will be happy to relate that.

First of all, I believe the funds involved for fiscal year 1992 and 1993 are a mixture of procurement and R&D funds.

Mr. Sabo. They were authorized as R&D but were appropriated as procurement funds.

Dr. Denman. When that original plan was put together, it was decided essentially by the group and then approved by the management team, that it should include not only scalable vector machines, which translates mainly to CRAY-type machines, but it also should include Leading Edge machines because it is a modernization plan. Your characterization of these machines as experimental, I don't believe, is correct because you can go to several companies today and find a catalogue that says here are the parallel processing machines——

Mr. Sabo. With the software in place?

Dr. Denman. Not nearly to the extent that a vector machine is in place, no. That was part of the reason that the group felt we should look to the future when the software will be fully matured and that won't happen unless we get the laboratories in place early. So it was decided that there should be a balance in the procurement and that was reflected in the report that came over to the Congress and that was reflected in the implementation plan that has been put in place. I believe nearly 50 percent of the money is going to the vector-type machines and 30 percent, I think–I better stop because I am not positive of the numbers. I will have to provide those for the record.

[The information follows:]

The Fy 1993 DOD HPC Modernization program allocated the combined FY 1992 and FY 1993 funds as follows: 46% for acquiring stable HPC systems capabilities; 33% for acquiring new scalable HPC systems; 14% for acquiring access to large scalable HPC systems capability in a collaborative arrangement with the national HP consortia; and 7% for acquiring high performance networking capability to tie all DOD Labs into the DOD HPC systems and the national HPC infrastructure.

Mr. Sabo. What are the plans for the $122 million requested for modernization in 1994?

Dr. Denman. I am not very clear on that. I have not kept up with that particular item. It was put in place by the Office of the Secretary of Defense; not by ARPA. I support it. I think it is something we must do to modernize our infrastructure within the government and I believe unless something happened that I am not aware of that a similar strategy would prevail to a balanced procurement of the scalable vector approaches.

[The information follows:]

In FY 1994 DOD will continue a balanced implementation of the three components of the DOD High Performance Computing (HPC) Modernization Plan—namely, acquiring stable HPC systems, achieving early access to the newest systems, and acquiring networking services to provide shared access to these computing resources for scientists and engineers DOD-wide. New competitive procurement programs are under preparation in all three components of the plan.

Specifically, in FY 1994 we will embark on establishment of four (nominally) major DOD shared HPC resource centers over the next several years. These centers will have a variety of computing system architectures, and comprise a spectrum of attributes from mature, stable systems to transitional and early access systems. These centers will provide for the large number of smaller centers employing early access systems only. The early systems are used for experimentation, explorations and very high performance requirements, described in the Modernization Plan, that we cannot yet fulfill.

Dr. DENMAN. I would like to clarify, what we call scalable vector machines are part of an overall high performance computing strategy; that is, the Cray-type of approach is one of building very capable, large single processors and perhaps maybe up to C–90–16 of those very high performance processers. On the other end of the spectrum you have the small scale processors of Thinking Machines that might put a thousand of these small processers in parallel. It is all in the same strategy of having scalable computing that we can scale by adding processors. I don't think we should try to polarize the technology by saying one thing is here and another thing is here because they are all part of a single strategy.

Mr. SABO. I don't quarrel that we should do some research, but the money was for machines that were workable and doing a full job currently rather than for R&D. It appears that those procurement funds have been used for purposes other than what they were directly appropriated for.

Dr. DENMAN. Well, obviously, when do you describe something as experimental? The CRAY C–90, when it first came out, many thought was experimental. There is software for all these parallel scalable machines. There is more for the vector approach than there is for the massively parallel approach. There is certainly a great deal of software around and many problems are very easily tuned to massively parallel machines. Other problems are best run on the vector-type of approaches. So I think we should end up with a mixture of these classes of machines driven by the technical problem one is trying to resolve.

I don't believe these should be classified as purely experimental. They are catalogue items from those companies. Granted, there is more maturity in the software for the vector approaches.

Mr. SABO. Thank you.

[CLERK'S NOTE.—Questions submitted by Mr. Sabo and the answers thereto follow:]

NUCLEAR NON-PROLIFERATION RESEARCH

Question. In the Conference report we adopted supplemental language which also required the Department to deliver a report which had been requested by the Senate in the FY 1992 Defense Appropriations Act. This did not relieve the Department of the responsibility of providing the House-requested report, nor did it relieve the Department of the responsibility to submit a prior approval reprogramming before spending the allocated money. Yet I understand that ARPA has begun to spend the nonproliferation funds we added to your budget.

a. Can you tell me, Dr. Denman, what you have done to ensure that further obligations are halted until the requested report and reprogramming are submitted? I understand our office notified your program manager and the Department of Defense Comptroller two weeks ago that there was a problem here. What has happened since then? Have funds been obligated in the past two weeks?

b. Are any further funds for these activities contained in your FY 1994 request? If so, what is your work plan? If not, how do you intend to complete the work you have begun with the FY 1993 money?

Answer. The FY 1993 Department of Defense Appropriation Act provided $15 million for non-proliferation research by the Advanced Research Projects Agency (ARPA).

a. In accordance with the Appropriations Act, the DOD Comptroller determined that the only requirement for release of the funds was the transmittal to the Congressional Defense Committees of the report mandated by the Senate and Conference reports in the FY 1992 Appropriations Act. The report, in two volumes and with classified annexes, was submitted on March 22, 1993.

b. The FY 1994 request contains funds to continue programs addressing methods for demonstrating technologies to enhance the monitoring of the Nuclear Non-Proliferation Treaty. Specific research efforts are planned in the following areas: advanced technologies for automatic sampling and analysis of nuclear materials for global nuclear proliferation monitoring; prototyping high-resolution room temperature radiation sensors into lightweight systems for proliferation monitoring; developing laboratory nanoscale particle analysis techniques for improved interpretation of nuclear samples; demonstration components for a global nuclear nonproliferation monitoring system; and installing prototypes in key locations in the mid-East and Asia near areas of nuclear concern.

Question. The Department has submitted a report in an attempt to comply with a requirement contained in the FY 1992 Defense Appropriations Act. The report basically lists ongoing and potential nonproliferation research projects, briefly describes them, notes which agencies are involved, and indicates which area of the nonproliferation problem they are designed to address. It does not, however, provide any information about cost, schedule, expected returns, priority, relation to other research projects, or an evaluation of how the project supports U.S. arms control goals.

In particular, last year's conference report language required that the report should assess the cost, schedule, and "expected results" of proposed proliferation research.

a. Why did the Department submit a report which so clearly did not meet Congressional directives?

b. When will the Department submit a report that provides the kind of details of costs, schedule, return, etc., that we need to make an informed judgment on these programs?

c. How well are you coordinating your proliferation research program—whatever it might be—with other agencies? Has the U.S.

Arms Control and Disarmament Agency determined that the proposed research would advance US arms control goals?

Answer.

a. On March 22, 1993, the Department submitted two reports in compliance with Title IV (RDT&E) of the Conference Report FY 1992 Department of Defense Appropriations Act (House Report 102–328). The two reports cover nuclear proliferation monitoring and chemical/biological weapon proliferation respectively. Each of the reports has a separate classified annex. As required, these reports specifically identify and summarize the extent to which all Federal departments are conducting research in the area of nuclear, chemical and biological weapons proliferation. As required, the reports specifically discuss the current programmed efforts for monitoring improvements to address deficiencies. A total of 56 specific technological areas were identified which offer the possibility to address deficiencies in current capabilities, or to provide an expanded and enhanced monitoring capability. The proposal for nuclear proliferation technologies, approved by the FY 1992 DOD Authorization Bill, but not funded, was part of a program to increase funding for the DOD nuclear monitoring program in FY 1992 by $16.2 million. Within this FY 1992 program, it was proposed to focus on basic verification technologies associated with nuclear proliferation ($6 million), development and deployment of nuclear proliferation sensors into areas of potential nuclear proliferation, including the mid-east and the southern hemisphere ($5 million) and fundamental technological developments in chemical and biological weapons monitoring ($1 million). Additional details, including costs, of this program were provided to the various defense committees in the summer of 1992, and this information was used by the Congress in their consideration of the FY 1993 Nuclear Nonproliferation Technology Initiative. The FY 1993 initiative as adopted provided $15 million for specific technologies, including detection methodologies, effluent analysis, and seismic sensors for detection of low-level nuclear testing. The department has provided the House Appropriations committee additional information on costs and technical programs as part of this initiative.

b. The Department submitted on May 10, 1993, a separate report to the Congress describing the role of the Department of Defense with respect to the nonproliferation policy of the United States. The report was submitted in compliance with Section 1503 of the National Defense Authorization Act for Fiscal Year 1993 (P.L. 102–484). The report addresses the Department of Defense nonproliferation programs and activities and the mechanisms for integrating them with those of other U.S. Government departments and agencies. Specifically, the report describes roles and missions for the relevant organizations within the Department of Defense in support of US government nonproliferation goals and objectives. The report identifies nonproliferation-related programs and activities within the DOD (including programs to detect and monitor clandestine weapons of mass destruction) to respond to terrorism and to accidents involving such weapons and to the theft of related weapons materials, and to assist with interdiction and destruction of weapons of mass destruction and related weapons materials. In addition, the report describes how the DOD programs are integrated and coordinated in support of the nonproliferation policy of the U.S. Government.

The nonproliferation policy of the U.S. acknowledges that the spread of weapons of mass destruction threatens its national security interests. In response, the U.S. has established a variety of initiatives to counter the spread of such weapons. The programs of the Department of Defense respond directly to the requirements for detecting, monitoring, and if necessary, countering clandestine weapons of mass destruction programs. The missions, roles, and activities of the Department of Defense materially contribute to the realization of the U.S. Government nonproliferation objectives.

c. The Department works continually to plan, develop, coordinate, and execute the nonproliferation programs. These coordination mechanisms are fully described in the report to the Congress. These coordinating bodies are especially critical to the success of the U.S. Government's ability to contain the proliferation of weapons of mass destruction. The U.S. Government agencies and departments involved in nonproliferation activities work together through this coordination to ensure orderly and effective policy implementation. The U.S. Arms Control and Disarmament Agency is involved in this process. At the highest level, the National Security Council serves as the final interagency coordination mechanism for the determination of U.S. nonproliferation objectives, goals, and policies.

NUCLEAR MONITORING PROGRAM

Question. I have some additional questions about your nuclear monitoring program. I note in your statement that ARPA "has the primary responsibility within the Department of Defense for developing the technologies which are needed to verify a nuclear test ban treaty".

a. On which technologies are you focusing?

b. How does your work in this area relate to the seismic research being conducted by the Department of Energy, the Air Force, the National Science Foundation, and other federal agencies?

c. How are the different research programs coordinated? Is any agency responsible for setting overall priorities? Does the Arms Control and Disarmament Agency work with you to determine the most productive use of research dollars?

d. Can you provide some specific examples of how, as you note in your statement, you have "significantly" reduced the costs of seismic sensors?

e. As I understand it, part of ARPA's mission is to transfer technologies to operating agencies. Which seismic systems has ARPA transferred, and to whom? What is your plan for transferring mature systems to other agencies?

f. I also understand that ARPA is promoting a system under which it would permanently retain control of a network of seismic arrays for treaty monitoring purposes. Would this not contravene ARPA's basic charter of focusing on "advanced research"?

Answer. a. ARPA, under its nuclear monitoring program, formulates and conducts programs in basic and applied research and development to strengthen the Department of Defense's capability to monitor foreign nuclear and other weapons of mass destruction activities. Technologies from these programs have application in a variety of Department of Defense missions: tactical warning and planning, intelligence, treaty monitoring, and international cooperative monitoring efforts. Within the Department of Defense, the ARPA program is the primary source of technical support for monitoring nuclear test limitations and demonstrating technologies which can be used in negotiations for nuclear treaties. The program provides frequent technical support to the Office of the Secretary of Defense, the National Security Council, the Department of State, the Arms Control and Disarmament Agency, the Joint Atomic Energy Intelligence Committee, and the Defense Intelligence Agency on issues related to their missions.

The FY 1994 program will focus on research, experimentation, and systems development for improved verification measures of a global nuclear test ban treaty and technologies to enhance the monitoring of the nuclear nonproliferation treaty. The program includes development of methods for the detection and identification of small events and technologies for automated signal analysis. Particular emphasis will be given to discriminating chemical from nuclear explosions. Advanced machine learning and neural net decision-making procedures will be developed. The ARPA program is part of the President's overall plan to prepare for monitoring a Comprehensive Test Ban Treaty.

Technologies and advanced computer systems development programs by ARPA are the primary source of many improvements and advanced capabilities for the U.S. Atomic Energy Detection System operated by the Air Force. The seismological research program of the Air Force Office of Scientific Research focuses on fundamental investigations, primarily by the academic community. These investigations sometimes lead to concepts that can be tested with large data sets by ARPA contractors and then incorporated into the systems being developed by ARPA, but most often they do not.

b. ARPA continues to work closely with the Department of Energy laboratories, particularly Sandia and Lawrence Livermore National Laboratory, which have unique data bases from the Nevada Test Site underground test program. To the best of our knowledge, the only National Science Foundation program even remotely related to seismic verification is their Global Seismic Network program aimed at improved understanding of the Earth's dynamics and structure. That program is primarily aimed at the installation of very broadband seismic stations around the world to image the interior of the Earth and further our understanding of the earthquake process. Data from these stations are used in the ARPA program when available and needed, but experience has shown that these data have not been particularly useful in the detection and identification of small events. These data will continue to be examined for their possible contribution to verification research.

c. ARPA makes a maximum effort to coordinate the nuclear monitoring program with both technical and policy agencies. The report submitted by the Department of Defense on May 13, 1993 outlines the interagency review process. In addition, there are frequent reviews within the Department of Defense and other agencies, joint evaluation of proposals, and joint participation on program advisory panels. Since much of the technology developed in the ARPA program is migrated into operational Air Force systems after it is developed, ARPA and the Air Force Technical Applications Center have cooperated closely in coordinating their respective programs and the Air Force has assigned personnel to research activities funded by ARPA to facilitate the transfer of technology.

The current ARPA research program is part of the President's overall plan to prepare for the negotiation of a comprehensive test bank treaty and monitoring of a comprehensive test ban treaty and monitoring of a treaty. ARPA works very closely with the U.S. Arms Control and Disarmament Agency in the technical support to the Conference on Disarmament. Policy guidance for this work is provided through an interagency committee headed by U.S. Arms Control and Disarmament Agency.

d. We stated that "our seismic array technologies have set the standard for ultra-sensitivity, and using advanced electronics we have significantly reduced the costs of these systems." Specific examples of electronic components whose costs have been reduced are the high dynamic range analog to digital converters, array controllers with synchronization to the global positioning satellite system timing system, and data acquisition hardware and software. Innovative techniques have been developed to deploy sensitive seismometers in boreholes for noise reduction without expensive installation equipment. When taken together, these measures have reduced the cost of an ultra-sensitive seismic array by over a factor of 5 in the last three years. Another significant cost-saving measure that has been adopted in the research program is in the area of reusable software. This has been possible because of adoption of specific standards for seismic systems. There are, at present, no seismic systems with comparable capability that can be installed at a lower cost, and ARPA is working to reduce the cost of these systems still further.

e. There are numerous examples of the transfer of ARPA-developed technologies to the U.S. Air Force Technical Applications Center, the operators of the Atomic Energy Detection System. These include borehole seismic sensors, data acquisition electronics, analytical methods, and software for signal processing. Seismic equipment for monitoring the Threshold Test Ban Treaty at stations in the former Soviet Union were developed by ARPA and transferred to the On-Site Inspection Agency. Technology and an advanced yield estimation system, including both a seismic and hydrodynamic capability, was developed and transferred to Air Force Technical Applications Center. In FY 1993, we began a three-year cooperative effort to transfer the technology of advanced seismic arrays and intelligent monitoring system components to the Atomic Energy Detection System. This transfer plan is proceeding on schedule.

f. ARPA is not promoting in any way permanent retention of any part of an eventual comprehensive test ban treaty monitoring system. ARPA will continue to provide leadership in the development of technology for nuclear test treaty verification through advanced research and demonstration which is consistent with ARPA's charter.

HIGH PERFORMANCE COMPUTING MODERNIZATION PLAN

Question. I understand that the Department is using last year's High Performance Computing Modernization Plan as the rationale for its actions. That plan does envision purchase of non-operational machines. However, the FY 1992 procurement funds were appropriated a year before the plan was delivered, and even after the plan was submitted in 1992, no funds were requested to implement it in the FY 1993 budget. All funds were provided by Congress, and were not part of any master plan.

Dr. Denman, do you have any comment?

Answer. You have asked me to comment on the Defense High Performance Computing Modernization Program. ARPA is very pleased to see such a program in execution, which is a coordinated, sustained program to rapidly deploy high performance computing systems and networks for Defense. It is not an ARPA program, but is managed by OSD, specifically DDR&E, and it cuts across all of the services and Defense Agencies. This seems to cause confusion between the High Performance Computing and Communications program, which is the R&D to develop the technologies for future generations, in collaboration with other Federal Agencies. Obviously, it is important to exploit the best results of computing to meet the operational and future needs of the DOD.

I would like to clarify some of the technology issues:

There are currently several military production codes running on scalable parallel machines, as well as many production processes in the commercial sector. I hope you will agree that the distinction between classes of "research" and "operational" machines tends to oversimplify the state-of-the-art. Both traditional vector and scalable parallel machines have "research" and "operational" versions.

The future vision of computing is real customers working in a heterogeneous computing environment, from small scale workstation to very large computing servers, all interconnected in a seamless and distributed way. One example of a company developing this capability is Cray Research Inc., and ARPA has been working with them for the past couple of years in a variety of projects. We currently have a cost shared project with them to develop a scalable Massively Parallel Processing (MPP) system, in conjunction with their families of vector systems which can be coupled to networks of other computational servers.

Software capabilities must also be scalable. While it is true that porting certain codes may take time, new algorithmic implementations required by evolving requirements also require significant coding. The cost performance of scalable parallel machines make it worth the effort to achieve the desired results. Many DOD researchers are already using these machines successfully, and their use is increasing as they learn how to exploit more parallelism.

Question. It is true that operational users were told they could not buy the supercomputers they had determined would be most useful for their needs, because the Department had an overriding supercomputer development initiative?

Answer. No. There simply were not sufficient monies to purchase all the machines the labs wanted. The plan that was delivered to Congress described the objectives and rationale for the program. Although no additional formal comments were received from Congress after publishing the plan, the DOD began to move into the first phase of execution with the full support of the services and Congressional encouragement. The objective of the program was to address the crucial step of integrating and deploying major computational advances into the DOD Science and Technology programs, and coupling them with military systems design and development.

Question. In your statement you note that the High Performance Computing Initiative—a research program—this year intends to deploy the "first trusted operating systems" for your scalable supercomputers. Does this mean DOD research personnel will be forced to accept machines without "trusted" operating systems?

Answer. "Trust" has different meanings—my statement used it in the formal sense that is widely used in the software research world. This means that the operating system may be formally certified to a specified level of security and trust against specific types of intrusions. This should not be confused with the common definition implying reliable and dependable service. There is currently no general purpose, "trusted" operating system for any computing system in the world today, where trust implies a measurable and quantifiable evaluation process. ARPA is working with NSA to adapt the Mach microkernel technology into a "trusted" operating system which my testimony was referring.

Question. You have requested $122 million for supercomputer modernization in FY 1994. What are your plans for this money? Which specific systems does ARPA classify as "stable?" Do you expect changes in such a list of stable systems?

Answer. The DOD modernization request was made by DDR&E, and is separate and distinct from ARPA programs. ARPA does not classify systems. However, based on the very rapid development of computing systems, I certainly support an evolutionary list to meet the evolving requirements and capabilities.

Question. How does the procurement program relate to the High Performance Computing Initiative research program?

Answer. The implementation of the HPC Modernization Program should draw upon the best computing technologies to deploy systems and networks in Defense R&D which meet current and future needs. The HPC research program is developing the basic supporting computing and communications technologies for future generations of high performance computers and networks, and is accelerating the maturation of the best results of the research program. The DOD HPC Modernization Program is deploying commercially available modern HPC systems for use by scientists and engineers in laboratories DOD-wide via high performance networks. The HPCC program and the DOD HPC Modernization program are synergistic and complementary.

Question. What role did ARPA play in making acquisition decisions for Fiscal Year 1993 under the DOD HPC Modernization Plan?

Answer. A management process was established by DDR&E and was used throughout the period. A DOD HPC Working Group

(HPCWG) was chartered to implement the Modernization Plan, and periodically briefed its efforts to DDR&E and the Science and Technology Working Group. ARPA serves as an advisor and as requested by DDR&E. An ARPA Program manager served as co-chairman of the HPCWG, and the proposals were evaluated by a technical review team of government experts. In addition, senior service S&T representatives were highly supportive of the process, plan, and implementation recommendations in the FY 1993 Implementation Plan. I participated in this group along with the leadership from each service, Defense Nuclear Agency, Office of Secretary Defense (Command, Control, Communications and Intelligence) and the Joint Staff.

Question. Was ARPA involved in any formal study to determine the real needs of researchers at DOD laboratories with respect to "Stable" (vector) HPC systems and "Early Access to Newest" (MPP) systems? How were researchers' needs determined?

Answer. This was not an ARPA process, but did include ARPA as part of the HPCWG. DDR&E solicited proposals from the Services and participating Defense Agencies. Each Service/Agency established its individual proposal roll-up process and submitted its proposals to DDR&E through its Science and Technology Working Group representative. The HPCWG was responsible for the evaluation process, integrating them into an Implementation Plan, and making recommendations to the DDR&E. I would also like to state that "stable" systems do not refer exclusively to classical vector machines. As stated in the Plan, "as newer systems become commercially viable and an identified user base develops, this component will add them to the installed base of the stable systems." Likewise, massively parallel machines are not the only ones that would be included in "Early Access to Newest" systems.

Question. Why don't the final FY 1993 acquisition decisions of DDR&E which stress MPP hardware at least as much as vector hardware, reflect the same priorities as the initial proposals submitted by the labs, which clearly emphasize vector acquisitions over MPP buys?

Answer. There simply was not enough money allocated to fund everything on the first round. The proportionate share of a balanced $87 million start must necessarily be different than a $215 million program, simply based on the size and cost of the large systems.

The FY 1993 DOD HPC Modernization program allocated the combined FY 1992 and FY 1993 funds as follows: 46% for acquiring stable HPC systems capabilities; 33% for acquiring new scalable HPC systems; 14% for acquiring access to large scalable HPC systems capability in a collaborative arrangement with the national HP consortia; and 7% for acquiring high performance networking capability to tie all DOD Labs into the DOD HPC systems and the national HPC infrastructure.

Question. Why are $12 million of the HPC Modernization funds, which are supposed to directly assist DOD researchers, going to an ARPA-sponsored consortium that has more none-DOD participants than DOD participants?

Answer. Collaboration with the National Consortia on High Performance Computing (NCHPC) enables DOD to access world-class researches solving similar problems with many years of experience on parallel machines. Working groups are being formed to address DOD's major problem areas, which will result in access to NCHPC's large machines, enormous savings in software development time, and substantial increased interaction with scientists across the country. The DOD Modernization plan describes the role of national consortia in the program as "leveraging HPC assets—computer systems, software, and applications." Modernization involves pursuing the best efforts in all computing areas. The current and future environments needed for DOD success in computing require DOD labs to link up with National Laboratories and Academic Universities. Collaborations already exist in the best interests of the government. Linking the modernization effort to non-DOD research communities is both natural, extremely cost-effective, and will provide enormous focus for some of DOD's most important grand challenges.

Question. What is the rationale for placing more than 2 or 3 early prototypes of a new MPP product at research laboratories?

Answer. The placement of machines is essential to early evaluation and experimental use. The exact number must be made on a technical basis and may vary from a small number of medium size machines to a moderate number of small machines. Early evaluation is needed by the developers to obtain rapid feedback, and put effective machines in the hands of real users. Explorations and early evaluations are needed by the users to determine which HPC technologies are best suited to their specific applications. For example, research efforts may be designed around software development requiring several small machines; new hardware capabilities may require both vendor and user interactions on one or more medium size machines; evaluations of a system stressed by different types of applications which might require several systems. To achieve the gain and results such as we have seen in HPCC, many of these research efforts should be done in parallel, not sequential or all on only one machine.

Question. In placing machines, why has ARPA shown a strong preference for Thinking Machines and Intel products and not involved a broader range of vendors? How does ARPA respond to the charge that its actions amount to a program of marketing the products of these two companies?

Answer. ARPA works with a variety of companies. In the particular time frame in question, these were the two major sources of large-scale parallel systems that had produced acceptable proposals. More sources have become available in the past two years and ARPA is also working with them. In addition, there are other agencies included in the HPCC program that are purchasing a variety of computer systems.

Question. What is ARPA doing now to broaden participation in its ongoing practice of placing new HPC machines at laboratories?

Answer. Please see answer to the previous question. We have also encouraged other Federal Agencies to adopt this practice as well.

Question. Why did ARPA discontinue issuing annual reports on its Strategic Computing Program after 1988? Lacking such public reference documents, how does ARPA assure that basic information about its HPC program is widely available and that researchers participation is as broad as possible?

Answer. The Director of DARPA at the time made that determination because most of the research reports and papers were being published in the technical community and presented at technical conferences open to the public. The National Coordination Office for the Federal HPC program has organized open technical meetings on various aspects of the overall program. ARPA too has held, and will continue to hold periodically, open technical symposia with HPC being an important agenda topic. An example of such a symposium is the June 22–24, 1993, 16th ARPA Technical Symposium, Newport, Rhode Island.

Question. Why is quantitative performance data for new MPP machines, such as the Thinking Machines CM–5, so slow to be made public? What can ARPA do to make performance data for new HPC designs widely available in a timely fashion?

Answer. As the new technologies stabilize and mature, performance measurements become more meaningful. The results being achieved are being collected and published by projects within the program. Some of these projects are making their results and experiments available on the Internet. For example, ARPA has had its national Consortium for HPC develop guidelines for performance measurement, and also has had a project in this area with the National Institute of Standards and Technology (NIST).

Question. How can ARPA reasonably expect to reach its goal of making MPP useful in addressing complex real-world problems by 1996 unless it shifts the emphasis of its program toward software?

Answer. From the very beginning, ARPA has invested heavily in scalable operating systems, compilers, languages, design tools, and development environments, which is why our "hardware" systems have been so successful. Furthermore, ARPA begins a major HPC Software initiative in FY 1991 that is now starting to produce important results in compilers, languages, and scalable library technology. I would estimate that approximately 30–50% of the ARPA program today is invested in software technologies and that ratio is growing. This consistent investment, combined with focusing on technologies which enable applications, will allow a balanced Federal program to meet its 1996 goals.

DEFENSE CONVERSION

Question. I am very glad we are discussing the defense conversion programs, and I know many firms are looking to the program to help them with the transition from defense to domestic industry.

a. I know the cost-sharing requirements in current law have become a problem. Is ARPA recommending a change in the law to the authorizing committee?

b. The fundamental purpose of the conversion program is to help American industry move away from defense from defense-oriented production. Do you have any kind of Buy American or U.S.-only requirement in the program? Is it possible for U.S. firms with foreign partners, corporate or university, to obtain conversion money?

c. Do you have any U.S.-only requirement, or even a U.S. preference requirement, in your other technology development program?

Answer. a. The cost-sharing requirement for the Defense Technology Reinvestmeng Programs (TRP) for FY 1993 was the result of committee language. Although the ARPA budget request for FY 1994 does not address cost-sharing, we believe it is a very important element and should be retained in some form. For example, consideration should be given to establishing 50 percent cost-sharing as a goal where practicable, with lesser sharing expressly authorized to maximize small- and medium-sized business participation. This would enable funding agencies to work with small- and medium-sized businesses on a fexible basis.

b. Firms eligible to participate in the TRP were defined by 10 USC § 2491(9). While the statute allows some foreign participation, it should be noted that all proposals will be evaluated in part on the pervasive impact they will have on the U.S. economy.

c. Most of ARPA's other technology development programs are executed through procurement contracts and are subject to the requirements of the Competition In Contracting Act. With limited exceptions, all sources including foreign sources are eligible to compete. However, contracts which are awarded, including awards to foreign sources, contain a "preference for U.S. industry" provision in the standard patent rights clause which requires an initial preference be give to production in the U.S. of products, invented under the contract, which are to be sold in the U.S. In cases where an ARPA "other transaction" under 10 U.S.C. 2371 is the appropriate award instrument we have imposed more stringent requirements under our "Foreign Access to Technology" clause.

[Clerk's note.—End of questions submitted by Mr. Sabo.]

CONTRACTOR TIERS

Mr. Dicks. Mr. Visclosky.

Mr. Visclosky. Doctor, in your testimony you talk about first, second and third-tier defense contractors. Could you give me a description or name of a company that would qualify for first, then second, then third tier so I would know what the distinction is?

Dr. Denman. They go over a spectrum. Hughes is a subcontractor in many cases to supplying avionics and so forth and they clearly have an experience in multiple markets at Hughes. So that is on the large end of it. When we were in New York we met with a very small company that was making very special gas filters used in a tank to pick particles out of gas. They are in the process of converting and being very competitive in making these same kind of filters for air bags for automobiles. These are wide extremes of a very small company. Their biggest problem was getting access to capital, because their bankers didn't feel this idea was one that they understood, but yet they were in fact being successful in converting into the automobile market. I think there are examples everywhere in between.

Mr. Visclosky. There is basically a differentiation on size?

Dr. Denman. I think size is a reflection of culture in the company. So a smaller company is a lot more flexible, can move more rapidly into another market. I think the other thing is many of our first and second-tier subcontractors are already in multiple markets and those that are already in multiple markets will have the best chance initially of succeeding. Whether any of our large monolithic defense contractors will even attempt to do that, that is problematical.

You have read about Bill Ander's approach to that. You could find a whole spectrum of approaches. Mike Armstrong at Hughes wrote where he wants to take his company, but I am not suggesting that we are trying to screen out any company that wants to come in and propose. I am just suggesting that based on the dialogue we have had to date, we will probably receive the best proposals from companies that are already in multiple markets.

Mr. VISCLOSKY. I guess my point is Tier 1, Tier 2, and Tier 3 is not a term of art that I need to know in terms of distinguishing between companies. It is more of a phrase you use in your testimony.

Dr. DENMAN. Yes, if you look at the prime contractor of a major weapon system it will have first tier subcontractors that may be a Hughes, a very large contractor. Hughes may have a second tier, that is Texas Instruments, that is receiving solder from some of the smallest contractors.

In the middle of that tier—I am suggesting that those companies in the middle of that tier have the most experience in multiple market and can more easily shift from a 30-percent commercial to a 70-percent commercial than can a General Dynamics making submarines. That is the only point I was trying to make.

STEEL RESEARCH

Mr. VISCLOSKY. In your testimony you talk about materials, and you mention ceramics several times, composite materials, metallic ones, in terms of free-form manufacturing.

Does ARPA participate in any research on steel?

Dr. DENMAN. Today we are not doing any specific R&D on any steel products, with the possible exception that we are doing an interesting partnership on the vestment casting industry that does casting of high quality steels. This is a partnership with a primary purpose of using simulation to simulate the pouring of complex castings so that you get the mold right the first time instead of going through a trial and error process.

Precision Cast Parts and Halmet are two of our largest precision casting houses mainly supplying the turbine engine business for blades and huge frame castings for engines. I believe some of that is done in steel. That is the only thing we are doing that might impact——

Mr. VISCLOSKY. We hear a lot about composite materials and ceramics. My impression is that it is a question of weight and strength.

Why the absence of steel? Has steel run its course as far as DOD is concerned for new applications, advancements, in terms of its applicability?

Dr. DENMAN. In terms of the needs for defense, I don't expect breakthroughs in increasing the stiffness our toughness of steel because it is a very mature technology. We have done research for, I guess, a thousand years on steel. It is just a matter of judgment of where the highest payoff is, and we believe there is more payoff in trying to get composites into applications.

Composites have six times the strength of steel and 10 times the stiffness of steel, rather large margins of performance in terms of strength and stiffness compared to steel.

So as you look at critical applications, whether in aircraft or lightweight mobile bridges for the Army, I believe the capabilities of composites remain untapped mainly because we didn't focus enough attention on processing; and the processing costs are far too high. We were paying, in some cases, 500 or 700 a pound for composites when the raw materials are 20, 30, $40 a pound. We haven't worked hard enough on the processing, and we are trying to focus our efforts on getting the costs down by orders of magnitude.

Mr. VISCLOSKY. Has the steel industry contacted you regarding any research and development they might be doing?

Dr. DENMAN. I personally have had no contact with any representative of the steel industry.

SPACE TECHNOLOGY

Mr. VISCLOSKY. You have talked about space and communications and, in terms of space technology, about the common bus which will be capable of supporting a variety of high mass fraction operational usable payloads in a wide range of orbits at a very low cost.

What is the time frame for that common bus coming on line?

Dr. DENMAN. We would like to do a demonstration of that in three years. We didn't start that this year because there was concern in the Congress that we were moving too fast with that approach. I feel strongly that there is an opportunity to cause fundamental change in the way we view many of our satellites, not all. Some will have to remain large, bulky, one of a kind.

Others I believe can be made such that you have—all the housekeeping functions are standard and the payloads, in effect, are just bolted on, and you plug into the power source and attitude control capability is there.

Today every satellite is a unique experience. They are all custom designed, tailored, not that we don't use common components in our satellites, we do; but the actual designs are all unique. We are trying to cause a fundamental change in that thinking. There are some that would rather not see that happen.

Mr. VISCLOSKY. In terms of satellites for communications, while in some ways our needs have grown a lot, that need is less sophisticated than it was several years ago. So for the common bus, you would be looking to that common satellite for some generic purposes?

Dr. DENMAN. Yes.

Mr. VISCLOSKY. The Chairman talked about fear of failure. I assume in terms of value of additional dollars spent at ARPA there must be some type of value system in place.

How are determinations made to cease pursuing an approach or a line of research?

And could you give us, for the record, an example of programs that were in place 12 or 18 months ago that were discontinued and a sense of why?

Dr. DENMAN. I will be happy to provide some of that.

[The information follows:]

There are several factors that would cause ARPA to cease pursuing an approach or line of research. Among the reasons are:

The technology was successfully transferred to a Military Department or to industry.

Objectives fulfilled and milestones attained.

Realignment of priorities within DOD or ARPA.

Anticipated results not achieved.

During the past year or so, we have elected to stop funding several efforts. Examples are:

The Strategic Adaptive Planning Experiment (SAPE), last funded in FY 1992, was ended because of the deemphasis on strategic missions.

Automated Signal Analysis effort—Funding was deleted in FY 1993 to allow a year of experience with the arrays before additional funding in FY 1994.

The Charged Particle Beam effort as suspended due to change of threat or mission of the Army and Navy.

The Sensor Protection effort reached the end of a joint five-year effort.

The DICE program reached the end of a Congressionally mandated effort (five-year).

The Ceramics Insertion program will end this year.

The High Temperature Structural Materials program is nearing the end of a planned six-year effort.

Dr. DENMAN. I think—if you look at the primary value added of an ARPA and I think why you have an ARPA is it is a set of very competent people who are in touch with the market place in the context of mainly military but also to a large extent—and we are going to have to grow our capability, in being in touch with the commercial marketplace.

So it is very much a judgment call. We do that in a collective forum with the key managers at ARPA.

One of the characteristics—and I like to say the "P" in ARPA is most important, "Projects" agency. We get into things, and we are able to get out of things; and we get out of things every year that are dead ended; or we lose customer support just like the X-ROD question. We basically lost customer support. We saw no path. While the Army supported it, in a generic sense there was no implementation path for that program; so we made the hard decision to wind it down.

We do that constantly, and most of the time it is a judgment basis. We don't have our high performance computers cranking out numbers to tell us when to start and when to stop programs. That is because we have such talented people I think we are able to make those calls. And our batting average is pretty good.

Mr. VISCLOSKY. A name was attached to a project by the prior administration but if, in the future—especially with the name change in ARPA—if we could resist the temptation to name products after tobacco products, I would be happy. I am talking about the Virginia Slim.

Thank you, Mr. Chairman.

ADVANCED SUBMARINE TECHNOLOGY

Mr. DICKS. Could you give me an update on the advanced submarine technology program.

Dr. Denman. We are in the process of going through major shifts in that program from focusing on the Blue Water Navy problems to focusing on the contingency issues we face in terms of threats that is the shallow water problem.

So we are refocusing our efforts to try to deal with what sometimes is called the littoral waters, shallow waters, near shore kind of problems. While this isn't totally new, it does present new sets of problems particularly in how do you extract acoustic signals from all the noise that exists in shallow waters.

The second shift is toward the whole business of approaches to design and construction of ships, whether submarines or other kinds of ships. We believe there is an opportunity to really use a lot of the computing technology to come up with whole new approaches for design and construction of ships. That is just in the beginning, a study step. I hope to come here next year and tell you that we really believe that there are opportunities to go forward in this area. We are, basically, in a study stage of that. But that is also a shift in our investments.

Mr. Dicks. What is the implication, in your mind, of the decision to terminate Sea Wolf and build Centurion?

How does such a decision affect the advanced submarine technology program?

Dr. Denman. Well, I don't think it has any abrupt impact on the program. The impact that is there, I believe, is a positive impact because some of the things that we have been working on for the past five years with strong support from this committee can now make it into the new Centurion design, whereas many of those technologies missed the window of opportunity for the Sea Wolf.

For example, I believe the hull mount penetrating periscope, will be implemented. It presents a major opportunity to change the design of the submarine because now you can put the periscope anywhere. Before you had to put the periscope near the center of buoyancy, center of gravity of the ship, because it had to penetrate, essentially, all decks of the ships. Now the only thing that penetrates the hull are some electrical feeds.

Lightweight propulsive systems, I believe, will find their way. It is an opportunity for the investments we have made over the last five years to find their way into application.

Mr. Dicks. Do you have a good working relationship with the Navy on this?

Dr. Denman. Yes, sir.

Mr. Dicks. What was the problem?

Dr. Denman. I wasn't at ARPA at the time, but it has been relayed to me. The Navy did not take kindly to shifting some of its resources to DARPA. It wasn't like it went on for years. It was in the first year. I think the Navy found that working with ARPA was to their advantage.

I have excellent working relationships with flag officers as well as key program managers of the Navy. So it not only moved new technology forward faster, it created new relationships between DARPA and the Navy which are very positive.

HIGH PERFORMANCE COMPUTING

Mr. DICKS. You have a request of $238 million for the next generation of super computers. Just for my own sake, give me an idea of the Federal high performance computer initiative and what are its goals?

Dr. DENMAN. The goals are to bring a whole new dimension to the computing business based on the scalable, massively parallel, kind of architecture.

This is a challenging job, requiring not only the hardware itself, but requires whole new architectures in the way computers are designed. It requires a new approach to the operating software for the computer. And I am pleased to state that I think we have, over the last year or so, brought some new concepts nearer to commercial fruition in what is called trusted operating systems that allow not only the system to work with parallel computers but also gives new approaches to security and privacy in the computing business.

Last, it requires application software, to have users postured and prepared to use these new architectures.

Mr. DICKS. Are there other Federal agencies involved?

Dr. DENMAN. Yes. The National Science Foundation is probably the closest to ARPA because they are working some of the most fundamental concepts in the computing architectures.

Then we are involved with NASA, DOE, mainly in applications. They are trying to put in place some of the first applications. So it is a multi-agency activity with ARPA having primary responsibility for the development side of the new computing architectures and software, et cetera.

Mr. DICKS. How are we doing, compared to other world competitors on high speed capabilities?

Dr. DENMAN. I believe we are still in clear leadership. The Japanese are penetrating the state of the art because of their ability for low-cost production.

You see a lot of computers, desk tops, et cetera, being imported. But in terms of the next generation, I believe it is unequivocal, largely because of this coordinated, high-performance computing program, that we have a distinct lead. I believe what was called their 5th generation computer project has gone off track, and they are regrouping and I believe getting onto the parallel computing track now. That is all the indications we have.

PROTECTING TECHNOLOGICAL ADVANTAGE

Mr. DICKS. One of my other assignments is in the intelligence arena. I know that you had a great deal of experience in this area as well. One of the concerns we have, is protecting our technological environment, one of which is high performance computing.

How does ARPA protect itself from espionage or other industrial activities by other countries? Over the years, this has unfortunately become a very major issue.

Dr. DENMAN. First of all, I believe that our front-line strategy in that regard, whether computing or anything else, is to run faster.

Mr. DICKS. To just compete and stay out in front?

Dr. Denman. I think that has to be the number one approach. If your fundamental strategy is protect what you know, it is very perishable. On the other hand, that doesn't mean that you just hand it away. I believe we are very sensitive to this issue.

In fact, a few years ago, there was a move to open up ARPA offices in Japan and in Europe, and working with my immediate predecessor, we decided to close the European office and not to open an office in Japan. We felt that foreign field locations could lead to a dialogue that I am not sure we really want to have because we are not interested in displaying the breadth and depth of our investment strategy.

I think ARPA brings an investment strategy to these programs, and we don't share that in a totally open way except where we want to do specific procurements.

Mr. Dicks. There are some companies I suspect—in order to be involved, which would allow a foreign country to be involved. What about SEMATECH?

Dr. Denman. When SEMATECH was chartered, it was required for only U.S. companies. That was an industry decision. But on the other hand, we just learned through a third party who was visiting Japan that one of our documents that was pretty fresh coming off of one of our high performance computing meetings was in the office of a Japanese researcher.

Mr. Dicks. There is no doubt in my mind that this is an area in which we will have to be increasingly sensitive. There was a recent article about the French having an espionage effort against the United States. The article indicated that the French are trying to find out a lot about our more advanced technology. I think it is something we will have to be very careful about.

Dr. Denman. There are two sides to it. There is a recent GAO look at the high performance computing program that suggested that we are not being open enough in getting the knowledge to U.S. research communities. There is a delicate balance that we need to maintain. I think the fundamental strategy has to be to stay ahead, to run faster, to compete.

HIGH DEFINITION DISPLAYS

Mr. Dicks. The Congress has appropriated a total of $250 million in the last three fiscal years for high definition display systems. The Committee directed the former Secretary of Defense to initiate a five-year research plan to field the technology and all its integrated components, which was never done.

What is the Department strategy to develop high definition display systems for DOD applications?

Dr. Denman. I am happy to report that for the first time we have a fairly substantial budget line about $66 million for high definition systems, or flat panel displays. In prior years, the most we ever had was $10 million. This committee in particular added substantial sums to this program.

Mr. Dicks. How would you rate this? Is this important?

Dr. Denman. Personally, I believe and there is quite a bit of study going on now, that it is an investment we must make. Not only is it a large market for a critical component for the military, it is also critical that we have access to the design processes and manufacturing for flat panel displays that will shape the design of whole computer systems.

Therefore, I believe if you are not in the flat panel display marketplace in design and fabrication, you may get forced out of some part of the computer marketplace. That is why I believe it is a strategic investment. On the other hand, U.S. industry is looking at at least $1 billion if not $2 billion in displays investment by the Japanese.

The Japanese are shipping massive quantities to the United States. The Apple Power Book's sales volume this year was limited by access to flat panel displays. I don't mean to imply they couldn't get access, because they received their target amount. However, the market demand for that computer exploded. We have had extensive dialogue with Apple, with Compaq, IBM, with all the computer makers, and they share our concern that we need to have access to this knowledge in the United States.

We are trying to stimulate that. On the other hand, it will be difficult for U.S. industry to step up to a now late investment. I think this technology is going to continue to mature and we are going to shift from what today is a liquid crystal based display technology to electroluminescence. If we can make the shift and at the same time move towards production, maybe that is our best strategy to make sure we are in this marketplace.

Mr. Dicks. Last Saturday, The Washington Post contained an article on the active-matrix-liquid-crystal-display manufacturing initiative which was funded by the Committee at Congressman Carr of Michigan's request, and I supported from the beginning. Can you give me the status of this program?

Dr. Denman. That specific part of the total high definition program was legislated to focus on establishing a pilot production capability. Now, a pilot production capability was defined to mean to meet military markets, particularly in the aircraft industry, which tend to be small displays (approximately 5-inch).

We implemented the program through a competitive process and we recently informed all bidders of the status—so I can share that with you. OIS of Michigan was accepted for awards. A proposal from AT&T with Standish and Xerox and some others was accepted for further discussion and restructuring of their proposal, and a third proposal—I am sorry, I can't remember the name—was rejected.

I believe the program is important to establish military supplies into niche markets, but as structured, it is not going to cause us to displace market share of the Japanese. It is not of a scale that is required to do that. You have to talk about half a billion dollars at least to penetrate that market in the liquid crystal kind of approach.

The other good news is that the best high performance liquid crystal display in the world is at Xerox Park from an ARPA program. It is phenomenal in terms of the definition that is in the displays. However it is still in the laboratory and the commitment to production is the hard step.

ARPA MANPOWER

Mr. Dicks. Any other problem areas that you see? Your budget has been doubled but your personnel has stayed the same. Is that going to be a difficulty for you?

Dr. Denman. We are getting some help with personnel. I am discussing with Dr. Deutch on some expansion. I don't believe we have to double our personnel in the doubling of the budget. I am sensitive to not shifting the culture of the agency. That is a very difficult thing to describe. It has to do with freedom of program managers, has to do with I have a very flat organization and generally there is only one person between me and the program managers. All of those characteristics I believe have to be preserved.

We are in dialogue and I am sure with help from your committee particularly and perhaps there are small problems that, if we increase people, we will have to have associated budget, so we may have to reprogram funds into those budgets.

CONVERSION EARMARKING

The number one problem I am concerned about is, if you look at this technology reinvestment area, if you look at the extensive earmarking that is there for 1993, I am concerned that that could be exacerbated in 1994 because we have a program that is not as precisely defined because we want to have a full and open competition to new players into the ARPA community, if you will. I will hope that we could work together and minimize those sorts of problems.

Mr. Dicks. I am sure that is something you will want to discuss with Chairman Murtha. I guess your concern is by the level of earmarking that you are not able to have as competitive a program?

Dr. Denman. That is correct and we scare off perhaps the good idea that could have been an absolute winner because it is pushed off to the side. The important difference in this particular part of our program and it is not dominating our program. It is $340 million out of $2.2 billion——

Mr. Dicks. How much of that is mandated?

Dr. Denman. In 1993, I believe about $150 million out of $450 million is earmarked, so it is not all-consuming. But I am concerned what the trend might be in that regard. Because it is different.

We are not sending over a highly definitive program to invest in technologies A through X. We are trying to keep that particular part of our program open to really new ideas as companies want to try to move from the Defense sector to the commercial sector. That lack of definition perhaps invites earmarking.

NUCLEAR WASTE

Mr. Dicks. That is one of the problems, the more vague it is, the more you open yourself up to people saying we all qualify so why don't we all have a project. A couple of things I have been interested in—one is the question of improving the technology for dealing with some of the defense nuclear waste issues.

This may all be under DOE, I believe that we have this enormous problem out there, as how to deal with the waste from the nuclear reactors that are producing nuclear materials over the Cold War era.

Is there any role that ARPA could play here in trying to help advance the technology? I am concerned that we don't have major technological advancements to deal with this problem. This type of work will be extraordinarily technical and difficult. Who should be dealing with the technology in this waste arena, this nuclear, chemical, whatever?

Dr. DENMAN. We are doing some work on the chemical side with innovative ideas on disposal of chemical wastes. It is called supercritical water. That takes a long time to explain the process. It is an innovative idea, and so far going along fairly well.

In the nuclear side, because DOE has the leadership there, we have not strayed into that arena, although I would say that as in any area, I believe that ARPA, if it finds a really super innovative idea, you can bet that we won't ignore it. But we are not actively seeking that. That is something we could look into further but, at this point, I don't have any program managers that are——

SUPERCONDUCTIVE MAGNETIC STORAGE

Mr. DICKS. One area that Secretary Aspin and I worked on was the super-magnetic energy storage system called SMES. Any comments on that technology or what its prospects are?

Dr. DENMAN. As I recall, that was connected with the high temperature super-connectivity activity.

Mr. DICKS. That is right.

Dr. DENMAN. Because of technological problems with the materials, we have turned away from the high current density power related applications. There are still some major problems that have to be solved before that material can sustain high occurrence. I can't explain the physics of it.

We shifted our attention to the lower power, the electronic applications, and are finding some excellent applications of the high temperature superconducting material.

Mr. DICKS. This particular program, I understand, is being handled by the Defense Nuclear Agency, so this is more a storage of electricity——

Dr. DENMAN. I think using the high temperature superconducting materials, the problem is those materials have not yielded the promise and the ability to carry high current. Therefore, fundamentally, it doesn't work very well.

Mr. DICKS. Thank you. I wish you well. We will continue to be very active supporters and we wish you well on your new challenges. There will be additional questions for the record. The Committee will adjourn until 10:00 o'clock tomorrow morning.

[CLERK'S NOTE.—Questions submitted by Mr. Skeen and the answers thereto follow:]

SMALL BUSINESS PARTICIPATION IN DUAL-USE TRP

Question. Dr. Denman, you mentioned in your testimony that the legislated cost-sharing requirements pose real problems for some TRP participants, especially small- and medium-sized businesses.

Would you elaborate on your recommendations to the Congress to alleviate these problems?

Answer. We believe that cost sharing is a very important element and should be retained in some form. For example, consideration should be given to establishing a 50 percent cost sharing as a goal, where practicable, with lesser sharing expressly authorized to maximum small- and medium-sized business participation. This would enable funding agencies to work with these firms on a flexible basis.

In addition, under the current legislation, if small businesses are unable to cost-share, they can participate by teaming with a large business or by competing in the Small Business Innovative Research [SBIR] portion of the TRP which does not require cost sharing.

FEDERAL AGENCY PARTICIPATION IN DUAL-USE TRP

Question. Dr. Denman, would you elaborate on the role of federal agencies in the TRP and clarify the statutory provisions on their participation in this program?

There seems to be some concerns from the agencies I represent in New Mexico that the statutory provisions may be too restrictive on their activities in the program and that consequently, dual-use technology transfers may be hindered.

Answer. Your question leads me to believe that you are asking about the participation of federal laboratories rather than agencies. The cost-sharing requirements called out in statute do prohibit any activity from being cost shared by DoD funds and discourage similar cost sharing from federal funds. This will inhibit federal laboratories from participating as stand-alone entities. However, resources brought to an activity by a federal laboratory are neutral, these resources neither serve as fund match nor do they require a fund match. Thus, participation of federal labs on teams of industry partners is very much encouraged and we hope to see many examples of federally sponsored technology developments being utilized in private sector products and processes.

[CLERK'S NOTE.—End of questions submitted by Mr. Skeen. Questions submitted for the record and the answers thereto follow:]

HIGH PERFORMANCE COMPUTING

Question. How will ARPA use the funds it is requesting in FY 1994 for this initiative?

Answer. Some of the key investments in FY 1994 will include:

Scalable systems to build upon the successses in scalable technology. ARPA intends to develop scalable interfaces for the new systems to enable their flexible configuration. Technology includes scalable I/O channels, parallel mass storage, and innovative microarchitectures while exploring alternative scalable concepts for models of computation, algorithms, computational methods, and operating systems. This will enable a uniform view from the user workstations through networks to large-scale computing systems; scalable software will focus on both scalability and real time; computers with efficient operating system environments with up to tens of thousand of processors; deployment of the first trusted operating systems; and demonstration of new approaches to high performance parallel libraries and languages; in networking, there will be a focus on experiments in the gigabit testbeds, new higher level protocols for all optical transmissions, measuring the limits of network performance. In addition, we plan to initiate an advanced technology component for the global Grid that will build upon the networking and other scalable technologies that are emerging.

Question. What are the long-term costs expected to be for the entire initiative? For ARPA?

Answer. ARPA does not have visibility into the nine other agency budgets involved in the Federal HPC program. For ARPA, we expect to spend approximately $2B from FY 1992–FY 1997.

Question. When are the key milestones?

Answer. The program is structured to have key milestones in each fiscal year. The broad milestones in the program include: Integrated scalable computing systems for workstations to large scale parallel systems capable of sustaining trillions of operations per second ready for experimental use by the end of 1996; Integrated software environments for these systems in the same time frame with a wide variety of applications software developed by the other agency programs; Integrated networking with gigabits to the workstation when needed with higher performance backbones. In addition, multiple communications channels of networks, ISDN, satellite, and cable TV will be integrated into the Internet with a variety of advanced information infrastructure services. In FY 1994 some important milestones include: Demonstrate real-time functionality into portable operating system technology; Demonstrate software and hardware capability between scalable commerical NPC systems and embeddable versions; Demonstrate small scale gigabit networks using both land and space-based communications channels, and develop trusted user services for scalable operating systems.

Question. For the record, for each fiscal year 1990 to 1994 break out separately each contractual or in-house effort of $100,000 or more, describe the work done, the contractor(s) involved, and whether the award was made competitively (and if not, the rationale from avoiding competition).

Answer. The Federal High Performance Computing (HPC) Initiative began in FY 1991 with the $20 million provided by the Congress. The FY 1992-1–93 HPC effort was financed in the ST–10 ad ST–19 Projects, and has been consolidated in a single Project in FY 1994. The following table provides the requested information.

[The information follows:]

HPC EFFORTS FOR FY91

Project	Title	Contractor	Competitive Status	Funds Committed
ST-19	NETWORK-BASED MULTICOMPUTERS	CMU	C	2,500,000
ST-19	TOUCHTONE PROTOTYPING	INTEL CORP	C	1,500,000
ST-19	SUBMICRON SYSTEMS ARCHITECTURE	CAL TECH	C	1,170,583
ST-19	VERY HIGH PERFORMANCE MIMD	TERA COMPUTER	C	1,000,000
ST-19	INTEGRATED MASSIVELY PARALLEL SUPERCOMPUTER	CRAY RESEARCH	C	1,000,000
ST-19	CAL TECH CONSORTIUM	CAL TECH	C	1,000,000
ST-19	TOUCHTONE OS RESEARCH	INTEL CORP	C	750,000
ST-19	ADVANCED PARALLEL COMPUTERS	USC ISI	C	705,000
ST-19	HIGH PERFORMANCE COMPUTING FACILITY	MADEN TECH	N	517,667
ST-19	LARGE SCALE FILING & DATA MANAGEMENT	UC LA	C	500,000
ST-19	IWARP/NECTAR	CMU	C	474,174
ST-19	COMPILER TECHNOLOGY/MASSIVE PARALLEL ARCHITECTURE	YALE U	C	400,000
ST-19	THE FOX PROJECT	CMU	C	350,000
ST-19	NETWORK ORIENTED SYSTEMS	BBN	C	329,776
ST-19	SCALABLE PARALLEL LIBRARY	U TENNESSEE	C	300,000
ST-19	COMPILING FOR ADVANCED MICROPROCESSOR	RICE U	C	300,000
ST-19	NETWORK COMMUNICATION RESEARCH	USC ISI	C	291,063
ST-19	HIGH SPEED OPTICAL NETWORKS	FORE SYSTEMS	C	269,456
ST-19	HIGH SPEED OPTICAL NETWORKS	NRL	IH	250,290
ST-19	SCALABLE MULTIPLE RESEARCH PROTOTYPE	INTEL CORP	C	250,000
ST-19	COMPILING FOR SIMD AND MIMD	SYRACUSE U	C	250,000
ST-19	JAPANESE TRANSLATION	NY U	N	240,000
ST-19	COMPUTER TECHNOLOGY DEVELOPMENTS	ATI	C	213,364
ST-19	THE ERGO PROJECT	CMU	C	200,000
ST-19	SCALABLE, OPEN PERF ENVIRON/PS	U ILLINOIS	C	200,000
ST-19	CENTER FOR ADVANCED SYSTEM TECHNOLOGY	USC ISI	C	169,630
ST-19	RELIABLE PARALLEL NETWORKS	OLD DOMINION U	C	163,638
ST-19	HIGH-SPEED NETWORK PERFORMANCE TESTING	GTE PRODUCTS	C	151,000
ST-19	HIGH SPEED OPTICAL NETWORKS	SYLVEST MGT SYS	C	150,218
ST-19	INFORMATION SCIENCE AND TECHNOLOGY STUDY (ISAT)	IDA	N	150,000
ST-19	TECHNICAL SUPPORT	RL	IH	146,139
ST-19	GIGABIT LAN AND APPLICATIONS	GTE LAB	C	140,000

Notes:

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   IH - In-house effort
2. These were early efforts to "fast start" the HPCC Program.

HPC EFFORTS FOR FY91

Project	Title	Contractor	Competitive Status	Funds Committed
ST-19	TERRAIN VISUALIZATION	SRI	C	139,977
ST-19	HIGH SPEED OPTICAL NETWORKS	PRC	C	135,326
ST-19	REMOTE FILE SYSTEM	U MINNESOTA	C	129,934
ST-19	MASS STORAGE SYSTEM	LBL	N	125,000
ST-19	PARALLEL COMPUTING COLLABORATION	RIACS	N	100,000
ST-19	PERFORMANCE MEASUREMENTS	NIST	IH	100,000
ST-19	PARALLEL VISION SOFTWARE LIBRARY	CMU	C	100,000
ST-19	ATM ROUTING AND FLOW CONTROL	NETEXPRESS	C	100,000
ST-19	MECHANISMS FOR ADVANCED MULTICOMPUTER	MIT	C	100,000

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HPC EFFORTS FOR FY92 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-10	PACKAGING	TEXAS INSTRUMENTS	C	2,939,725
ST-10	SOFTWARE ARCHITECTURE / MACHINE CONTROL	MARTIN MARIETTA	C	2,300,000
ST-10	MCM FOUNDARY	E-SYSTEMS	C	2,000,000
ST-10	COMPUTING RESEARCH TECHNOLOGY SUPPORT	USC ISI	C	1,957,415
ST-10	AUTOMATED PLANNING EXPERIMENT/WARBREAKER	BDM CORP	N	1,900,000
ST-10	HIPER-D	GE	N	1,695,000
ST-10	ROBOT SYSTEM DEVELOP & TESTING	CMU	C	1,604,990
ST-10	INTERACTIVE PROBLEM SOLVING	SRI	C	1,416,779
ST-10	SPOKEN LANGUAGE RECOGNITION AND UNDERSTANDING	MIT	C	1,400,000
ST-10	DSSA FOR ASSOCIATE SYSTEMS	ISX	C	1,341,605
ST-10	RESEARCH ON SPOKEN LANGUAGE	CMU	C	1,320,000
ST-10	CARTOGRAPHIC MODEL ENVIRONMENT ENHANCEMENTS	GE	C	1,250,000
ST-10	HIGH SPEED PACKAGING	MAYO FOUNDATION	C	1,204,708
ST-10	SORTING TECHNOLOGY DEVELOPMENT	DRAGON	C	1,017,659
ST-10	ADV SIMULATION TECHNOLOGY	BBN	N	1,000,000
ST-10	DARPA/AEGIS HIPER-D EXPERIMENT	NAVSEA	IH	1,000,000
ST-10	RADIUS RESEARCH	HUGHES RESEARCH LAB	C	1,000,000
ST-10	REAL-TIME INTERACTIVE SPOKEN LANGUAGE SYSTEMS	BBN	C	1,000,000
ST-10	GISTING TECHNOLOGY DEVELOPMENT	BBN	C	971,648
ST-10	ENHANCED MISSION DEVELOPMENT & EXECUTION	BBN	C	900,000
ST-10	RESEARCH IN INFO SCIENCE & TECHNOLOGY	COLUMBIA	C	900,000
ST-10	INTEGRATED SENSOR NETWORK PROJECTS	SARCOS RESEARCH	C	864,123
ST-10	ACQUISITION MGMT ASST-KNOWLEDGE-BASED REASON	TASC	C	848,780
ST-10	TECHNICAL SUPPORT	MERIDIAN CORP	C	800,000
ST-10	BASIC RESEARCH IN COMPUTER SCIENCE	CMU	C	796,010
ST-10	DECISION SUPPORT FOR TRANSPORT PLAN	SRI	C	744,000
ST-10	VISION-BASED NAVIGATION & RECOGNITION	U MARYLAND	C	740,000
ST-10	DETECTION AND EXTRACTION TECH	U MASS	C	729,744
ST-10	ROBUST CONTINUOUS SPEECH RECOGNITION	BBN	C	729,019
ST-10	DECISION THEORETIC APPROACH	ROCKWELL	C	700,000
ST-10	DATABASE INTERFACE FOR KNOWLEDGE BASED PLANNING	UNISYS	C	700,000
ST-10	IMAGE UNDERSTANDING ROBOT NAVIGATION	U MASS	C	665,000

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HPC EFFORTS FOR FY92 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-10	PARALLEL HIGH SPEED OPTICAL	MIT LINC LABS	C	660,000
ST-10	AUTOMATIC GENERATION OF ENGINEERING ANALYSIS	CORNELL	C	649,000
ST-10	DATABASE AND PERFORMANCE EVALUATION SUPPORT	NIST	IH	635,000
ST-10	PARALLEL COMPUTING ACCESS	NYSERNET	C	615,762
ST-10	LARGE VOCABULARY CONTINOUS SPEECH RECOGNITION	DRAGON SYSTEMS	C	600,000
ST-10	OPEN MATRIX	ENTERPRISE INTEG	C	600,000
ST-10	ADVANCED VEHICLE INTEGRATION	MARTIN MARIETTA	C	599,598
ST-10	PERCEPTION FOR OUTDOOR NAVIGATION	CMU	C	597,000
ST-10	SCALABLE GENERAL-PURPOSE SHARED MEMORY	STANFORD	C	580,000
ST-10	HIPER-D PROGRAM	JHU-APL	C	575,000
ST-10	EXPECT - TOWARDS KNOWLEDGE-BASED SIMULATED AGENTS	USC ISI	C	575,000
ST-10	DOMAIN EXPERTISE FOR KNOWLEGE-BASED PLANNING AND SCHEDULING	SRA CORP	C	559,788
ST-10	INTERNET OPERATIONS	BBN	C	550,000
ST-10	LOW COST, HIGH DENSITY LASER	BELL LABS	C	550,000
ST-10	NATURAL LANGUAGE UNDERSTANDING BENCHMARKS	NCCOSC	IH	541,000
ST-10	COMPUTATION TECHNIQUES FOR MULTIPLE SIGNAL PROCESSING	ARGO SYSTEMS	C	532,994
ST-10	SAPE CONCLUSION AND AGENT SUPPORT	MCDONNELL DOUGLAS	C	510,000
ST-10	COMPUTER AIDED GEOMETRIC DESIGN	U UTAH	C	503,813
ST-10	TECHNICAL SUPPORT	MERIDIAN CORP	C	501,773
ST-10	VLSI TECH FOR RELIABLE LARGE-SCALE COMPUTING	MIT	C	500,000
ST-10	KNOWLEDGE-BASED VISION TECHNIQUES	SRI	C	500,000
ST-10	MITRE MANAGEMENT/TECHNICAL SUPPORT	MITRE	N	492,434
ST-10	GABOR REPRESENTATIONS	ATL AERO ELEC	C	491,470
ST-10	RESEARCH ON KNOWLEDGE-BASED TECH FOR ENGINEERING APPLICATIONS	STANFORD	C	479,847
ST-10	DIGITAL SIGNAL PROCESSING	AWARE INC	C	478,997
ST-10	PARALLEL SCALABLE LIBRARIES	U MINN	C	473,176
ST-10	MATHEMATICAL LIBRARY SOFTWARE	PRINCETON	C	441,233
ST-10	INFRASTRUCTURE - UBIQUITOUS COMPUTING	XEROX	C	436,491
ST-10	ALGORITHMS/MULTI-LING DATA	BBN	C	436,428
ST-10	DETECTION AND EXTRACTION TECHNIQUES	HNC CORP	C	432,643
ST-10	MASS SPECTROGRAPH ON A CHIP	WESTINGHOUSE	C	431,141
ST-10	WAVELET TECHNOLOGY	AWARE INC	C	429,530

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HPC EFFORTS FOR FY92 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-10	INTEGRATED PCS TECHNOLOGIES	ISR	C	423,024
ST-10	TECHNICAL SUPPORT	MERIDIAN CORP	C	410,000
ST-10	ROBUST CONCEPT SPOTTING	MIT LINC LABS	N	400,000
ST-10	INTEGRATION OF OPTIMAL SCHEDULING	GE	C	400,000
ST-10	RAPID PROTOTYPING FOR CIM	TEES	C	400,000
ST-10	GEDAE FOR TESTBED NETWORK	GE AEROSPACE	C	382,667
ST-10	SMART VISION SENSORS	MIT	C	375,900
ST-10	NIST	NIST	IH	375,000
ST-10	WIRELESS COMMUNICATIONS MODULES	UC BERKELEY	C	374,320
ST-10	GENERALIZED CROSSBAR	OPTIVISION	C	363,728
ST-10	NIST TEXT RETRIEVAL	NIST	IH	353,400
ST-10	INTELLIGENT SYSTEMS EVOLUTION	BBN	C	348,000
ST-10	CONCURRENT INTEGRATED DESIGN AND MANUFACTURING (CIDAM)	U UTAH	C	346,187
ST-10	NONLINEAR SIGNAL PROCESSING TECH	U VIRGINIA	C	331,375
ST-10	ADIABATIC SWITCHING CIRCUITS	USC ISI	C	330,109
ST-10	AUTOMATED CLUSTER TELECONFERENCE	USC ISI	C	329,133
ST-10	GENERIC TOOLS FOR TRANSPORT PLANNING	KESTREL INST	C	328,000
ST-10	III-V EPITAXIAL LIFT-OFF PROCESS	KOPIN	C	325,000
ST-10	RECONFIGURABLE OPTICAL INTEGRATION	INTEL CORP	C	307,877
ST-10	LASER WRITE	MIT LINC LABS	N	305,000
ST-10	LARGE-SCALE NONLINEAR PROGRAMING	IBM	C	304,003
ST-10	SPOKEN LANGUAGE SYSTEMS	BBN	C	303,611
ST-10	DARPA ENGINEERING AND MANUFACTURING	IDA	N	300,000
ST-10	MOSIS	USC ISI	C	300,000
ST-10	APPLICATION-DRIVEN CAD FOR MICRODYNAMIC SYSTEM	MIT	C	299,339
ST-10	HARDWARE TECHNOLOGY ROBUST PERSONAL COMMUNICATIONS TRANSCEIVEF	UC LA	C	292,268
ST-10	INFRASTRUCTURE COMPUTING ARCHITECTURES	USC ISI	C	291,130
ST-10	UNIFIED THEORY OF DIST COMM COMP	STANFORD	C	290,894
ST-10	DETECTION AND EXTRACTION TECHNIQUES	GE	C	286,009
ST-10	UUGM CODE DEVELOPMENT	SAIC	C	285,961
ST-10	CONTRACT MANAGEMENT AND TECHNICAL SUPPORT	TACOM	IH	280,000
ST-10	CROSS-BAR SWITCH APPLICATIONS	MIT LINC LABS	C	265,611

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HPC EFFORTS FOR FY92 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-10	TECHNICAL SUPPORT	RL	IH	254,656
ST-10	SERVICES & INFORMATION MANAGEMENT FOR DECISION SYSTEMS	USC ISI	C	254,000
ST-10	ULTRA LOW POWER CIRCUIT TECH	JPL & LWL	C	251,000
ST-10	PACKAGING FOR ELECTRONIC COMPONENTS	MAYO FOUNDATION	N	250,000
ST-10	NOVEL TECHNOLOGIES	TACAN	C	250,000
ST-10	ADVANCED OPTOELECTRONIC DEVICE	ROCKWELL	C	250,000
ST-10	SOLUTION OF EIGENPROBLEMS	ARGO NATL LAB	N	240,000
ST-10	MITRE ARTIFICIAL INTELLIGENCE SUPPORT (PROJECT 88430)	MITRE	C	232,500
ST-10	TDM WITH OPTOELECTRONIC SWITCHES	NCCOSC	IH	230,000
ST-10	HP SPEECH RECOGNITION/CONSISTENCY	SRI	C	228,031
ST-10	MICROELECTROMECHANICAL SYSTEMS	U UTAH	C	227,387
ST-10	NANOMECHANICAL GENERIC SENSOR	CORNELL	C	224,137
ST-10	VISUAL. AND MODEL FOR INTERACTION PLAN DEVELOP & PLAN STEERING	U MASS	C	222,218
ST-10	EXPERT SYSTEM FOR IMPLEMENT HIGH PERFORMANCE ALGORITHMS	OHIO ST	C	219,008
ST-10	SHAPE BASED IMAGE RESTORATION	COGNITECH	C	203,990
ST-10	EPITAXIAL LIFTOFF TECHNOLOGY	UC LA	C	200,000
ST-10	SOLIDIFICATION AND FAST ALGORITHMS	INST ADVANCED STUDIES	C	200,000
ST-10	THREE CENTRAL PROBLEMS IN LARGE SCALE COMPUTATION	NIST	IH	200,000
ST-10	LARGE SCALE FILING & DATA MANAGEMENT	UC LA	C	200,000
ST-10	MULTI-DEM DATA COMPRESSION	STANFORD	C	200,000
ST-10	TECHNICAL SUPPORT	NSWC-IH	IH	200,000
ST-10	DETECTION AND EXTRACTION TECHNIQUES	SYRACUSE	C	196,000
ST-10	CREATION OF SPEECH CORPORA	NIST	IH	193,500
ST-10	RESEARCH IN IMAGE UNDERSTANDING(RADIUS)	SRI	C	187,500
ST-10	2-PHOTON OPTICAL 3D MEMORY CALL	CALL/RECALL	C	185,000
ST-10	INSERTION OF OPTICS INTO MULTIPROCESSOR	HONEYWELL	C	181,308
ST-10	GABOR PROCESSING	ATL AERO ELEC	C	175,390
ST-10	UGV TECH INTEGRATION SUPPORT	MICOM	IH	175,000
ST-10	JAPANESE TRANSLATION	NY U	N	172,418
ST-10	MODEL-BASED RECOGNITION OF OBJECTS IN COMPLEX SCENES	STANFORD	C	172,109
ST-10	CONCURRENT ENGINEERING DIRECTORATE SUPPORT	CECOM	IH	165,528
ST-10	RESEARCH IN INTEGRATED LISP/C	ADS	C	165,000

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HPC EFFORTS FOR FY92 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-10	DETECTION AND EXTRACTION TECHNIQUES	NEW MEXICO ST	C	162,285
ST-10	NUMERICAL ALGORITHMS FOR COMPRESSIVE TURBULENCE	BROWN U	C	160,050
ST-10	FAST IMAGE CORRELATION VELOC.	UC SD	C	159,824
ST-10	POWER-EFFICIENT COMPUTATION	MIT	C	158,700
ST-10	SELF-CLOCKED STRUCTURES FOR LOW POWER SYSTEMS	STANFORD	C	158,286
ST-10	INTEGRATED PARALLEL ANALOG SP	CMU	C	158,000
ST-10	WAFER-SCALE SYSTEMS TECHNOLOGY FOR STRATEGIC COMPUTING	MIT LINC LABS	N	150,000
ST-10	PROGRAM SUPPORT	SYS PLA	C	150,000
ST-10	TTM/TRANSPORT PLANNING TEMPORAL	HONEYWELL	C	150,000
ST-10	FAST FRAME 3D LASER IMAGER	ODETICS	C	150,000
ST-10	OSD UGV TECHNICAL & ADMIN ASSIST	ARL-AD	IH	150,000
ST-10	INTEGRATION OF FERROELECTRIC SEMICONDUCTORS	ROCKWELL	C	149,964
ST-10	SOFTWARE TECH TRANSFER AGENT	ENTROPIC RESEARCH LAB	C	148,117
ST-10	RESEARCH IN TEXT UNDERSTANDING	SRI	C	147,384
ST-10	RADIO PROPAGATION PREDICTION	VPI	C	143,846
ST-10	PROTOTYPING FOR DARPA IMAGE UNDERSTANDING ENVIRONMENT	GEORGIA TECH	C	142,082
ST-10	NON-LINEAR DYNAMICS	U NORTH CAROLINA	C	134,070
ST-10	APPLICATION OF THE TENSOR	ST CLOUD ST	C	133,088
ST-10	NUMERIC & SYMBOLIC PROCESSING	MIT	C	125,000
ST-10	ROBOTIC TECH TRANSFER SUPPORT	ARL-GOA	IH	125,000
ST-10	PARALLEL SIMULATION AND CAD SYSTEMS	AFIT	IH	125,000
ST-10	IMAGE ANALYSIS, SYNTHESIS & PERCEPTION OF DYNAMIC 3-D SCENES	U ILLINOIS	C	124,999
ST-10	TECHNICAL SUPPORT	NSA	IH	120,000
ST-10	LARGE COMPLEX NONLINEAR MANUFACTURING	BROWN U	C	117,912
ST-10	RESEARCH IN INTEGRATED LISP/C	BOOZ ALLEN	C	116,250
ST-10	SUPPORT DARPA BASIC RESEARCH & HPCC PROGRAM	SPRINT	C	107,438
ST-10	EPITAXIAL LIFTOFF TECHNOLOGY	BELLCORE	C	100,000
ST-10	SYNCHROTRON X-RAY DIFFRACTION	TUFTS U	C	100,000
ST-10	3D STEREO IMAGING	REVEO	C	100,000
ST-10	TECHNICAL SUPPORT	AICS	IH	100,000
ST-10	OPTOELECTRONIC TECHNOLOGY ROADMAP	NOT SEL	C	100,000
ST-10	SMART SPATIAL LIGHT MODULATORS	UC SD	C	100,000

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HPC EFFORTS FOR FY92 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-19	MOSIS BROKER	USC ISI	C	4,120,336
ST-19	THE STAR T PROJECT	MIT	C	3,910,922
ST-19	SCALABLE MULTIPLE RESEARCH PROTOTYPE	INTEL CORP	C	3,750,000
ST-19	HIPER-D PROGRAM	JHU-APL	N	3,679,684
ST-19	HETEROGENOUS DISTRIBUTED COMPUTING	WPI	C	3,200,000
ST-19	INFRASTRUCTURE COMPUTING ARCHITECTURE	USC ISI	C	3,014,722
ST-19	ADVANCED CONNECTION MACHINE	THINKING MACHINES	C	3,000,000
ST-19	INTEGRATED MASSIVELY PARALLEL SUPERCOMPUTING	CRAY RESEARCH	C	3,000,000
ST-19	DESIGN AND PROTOTYPE OF HARD REAL TIME SYSTEMS	UC BERKELEY	C	2,932,558
ST-19	TECHNOLOGY TRANSITION - SPECIAL HPC ENTERPRISE FACILITY	MADEN TECH	N	2,597,000
ST-19	NETWORK-BASED MULTICOMPUTERS	CMU	C	2,500,000
ST-19	TOUCHTONE PROTOTYPE	INTEL CORP	C	2,450,000
ST-19	TECHNOLOGY TRANSITION - SPECIAL HPC ENTERPRISE FACILITY	MADEN TECH	N	2,332,947
ST-19	NETWORK-BASED MULTICOMPUTERS	CMU	C	2,300,000
ST-19	VERY HIGH PERFORMANCE MIMD	TERA COMPUTER	C	2,000,000
ST-19	WAFER-SCALE TECH FOR STRATEGIC COMPUTING	MIT LINC LABS	N	1,916,000
ST-19	BASIC ENGINEERING OPTION	TERA COMPUTER	C	1,750,000
ST-19	COMPUTING RESEARCH TECHNOLOGY SUPPORT	USC ISI	C	1,589,000
ST-19	ADVANCED CONNECTION MACHINE	THINKING MACHINES	C	1,500,000
ST-19	3D DIAMOND MCM TECH DEVELOPMENT	E-SYSTEMS	C	1,500,000
ST-19	HIPER-D PROGRAM	GE	C	1,305,000
ST-19	TRUSTED MACH DEVELOPMENT	TRUSTED SYSTEMS	C	1,300,096
ST-19	TOUCHTONE OPERATING SYSTEM RESEARCH	INTEL CORP	C	1,250,000
ST-19	CERT COORDINATION CENTER	SOFTWARE ENG INST	C	1,250,000
ST-19	ADVANCED PRODUCTION TECHNOLOGIES	USC ISI	C	1,213,233
ST-19	EMBEDDABLE VARIANTS	USC ISI	C	1,194,274
ST-19	DISTRIBUTED OPERATING SYSTEM FOR HIGH PERF COMPUTING	OPEN SOFTWARE	C	1,163,420
ST-19	SUBMICRON SYSTEMS ARCHITECTURE	CAL TECH	C	1,114,292
ST-19	SCALABLE PARALLEL LIBRARY	U TENN	C	1,100,000
ST-19	PROJECT DATAFLOW	MIT	C	1,084,375
ST-19	RAPID PROTOTYPING - HIGH DENSITY	MCC	C	1,050,000
ST-19	HIGH PERFORMANCE COMPUTING FACILITY	MADEN TECH	N	1,043,002

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HPC EFFORTS FOR FY92 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-19	SCIENTIFIC VISUALIZATION CONSORTIUM	U UTAH	C	1,000,000
ST-19	SCALEABLE SHARED MEMORY MULTIPROCESSOR	STANFORD	C	986,000
ST-19	DARPA/AEGIS HIPER-D EXPERIMENT	NAVSEA	IH	925,000
ST-19	GIGABIT LOCAL ATM NETWORKS	BELLCORE	C	915,725
ST-19	PARADIGMS FOR UNIVERSALITY	MIT	C	900,123
ST-19	THE FOX PROJECT	CMU	C	900,000
ST-19	GOVERNMENT APPLICATIONS OF FAST TECHNIQUES	USC ISI	N	879,718
ST-19	ISIS DISTRIBUTED PROCESSING TOOL	CORNELL	C	834,772
ST-19	GIGABIT VIRTUAL CONNECTION LANS	CMU	C	825,000
ST-19	LARGE SCALE FILING & DATA MANAGEMENT	UC LA	C	800,000
ST-19	HIGH SPEED OPTICAL NETWORKS	NRL	IH	800,000
ST-19	NETW0RK RESEARCH FOR MAGIC GIGABIT TESTBED	MINN SUPERCOMPUTER	C	794,259
ST-19	CAM-8	MIT	C	785,000
ST-19	INFORMATION SECURITY FOR NETWORKED SYSTEMS	TRUSTED SYSTEMS	C	783,675
ST-19	ATM-BASED LOCAL AREA NETWORKS	XEROX PARC	C	778,811
ST-19	CAD FRAMEWORK AND TOOLS	USC	C	772,607
ST-19	COMPILING FOR SIMD AND MIMD	SYRACUSE	C	750,000
ST-19	COMPILER TECH/MASSIVE PARALLEL ARCHITECTURES	YALE U	C	749,589
ST-19	NETWORK-BASED MULTICOMPUTERS	CMU	C	712,000
ST-19	EMBEDDED MILITIARIZED TOUCHSTONE	HONEYWELL	C	706,000
ST-19	COMPILING FOR ADVANCED MICROPROCESSOR	RICE U	C	700,000
ST-19	CENTER FOR ADVANCED SYSTEM TECHNOLOGY	USC ISI	C	667,390
ST-19	SUPPORT OF THE MCC CAD FRAMEWORK	MCC	C	664,205
ST-19	METHOD FOR EMBEDDED MICROSYSTEMS	MISS ST	C	626,240
ST-19	EVALUATION SCALABILITY OF KSR-1 SHARED MEMORY PARALLEL COMPUTER	CORNELL	C	625,000
ST-19	MILNET SUPPORT	USC ISI	C	594,281
ST-19	MECHANISMS FOR ADVANCED MULTICOMPUTER	MIT	C	589,423
ST-19	MAGIC TESTBED APPLICATION DEVELOPMENT AND RESEARCH	SRI	C	587,485
ST-19	DEVELOPMENT OF DESIGN AND MODELING	MAYO FOUNDATION	C	582,826
ST-19	INTELLIGENT FILE SYSTEMS FOR OBJ	MIT	C	581,636
ST-19	COMPUTATIONAL MODELS, LANG., & COMPILERS FOR MASS. PAR. MACHINES	HARVARD	C	548,000
ST-19	ALGORITHMIC SOLUTIONS TO PROBLEM	MIT	C	540,000

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HPC EFFORTS FOR FY92 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-19	SYNTHESIS OF TIMING-CONSTRAINED VLSI SYSTEMS	U WASHINGTON	C	536,236
ST-19	TMACH EVALUATION	NIST	IH	518,450
ST-19	HETEROGENOUS DISTRIBUTED COMPUTING	WPI	C	500,000
ST-19	NSF GRAND CHALLENGE	VARIOUS	C	500,000
ST-19	PARALLEL ADAPTIVE DEVICE SIMULATION	STANFORD	C	499,933
ST-19	TRUSTED MACH DEVELOPMENT	TRUSTED SYSTEMS	C	467,607
ST-19	GIGABIT INTERNETWORK IMAGE SERVER SYSTEM	LBL	N	459,375
ST-19	PPL CELL MATRIX BASED SYSTEMS	U UTAH	C	454,423
ST-19	CERPASS	USC ISI	C	450,000
ST-19	SCALABLE, OPEN PERF ENVIRON/PS	U ILLINOIS	C	440,000
ST-19	ARTIFICIAL INTELLIGENCE SUPPORT	MITRE	N	420,000
ST-19	EXPORT SAFEGUARDS DEMONSTRATION	TRUSTED SYSTEMS	C	418,779
ST-19	PROJECT DATAFLOW	MIT	C	401,521
ST-19	SECURITY INCIDENT RESPONSE CAPABILITY SUPPORT & RESEARCH	NIST	IH	400,000
ST-19	ICVISION	U ALABAMA	C	400,000
ST-19	ULTRA-HIGH SPEED ACCELERATION OF DIGITAL SYSTEMS	U CINCINNATI	C	363,947
ST-19	LANGUAGES, LIBRARIES, AND PERFORMANCE EVALUATION TOOLS	INDIANA	C	354,549
ST-19	ARCHITECTURES, CIRCUITS & CAD	STANFORD	C	351,075
ST-19	SYNTHESIS & VERIFICATION FOR COMBINED SEQUENTIAL & BEHAVIORAL LOGIC	U COLORADO	C	350,382
ST-19	COMPILER DEVELOP FOR IMAGE UNDERSTANDING	AMERINEX	C	350,000
ST-19	ADVANCED SYSTEM PACKAGING SERVICES	USC ISI	C	328,529
ST-19	NBS PERFORMANCE MEASUREMENT	NIST	IH	300,000
ST-19	CAD OF HIGH-PERFORMANCE COMMUNICATIONS	UC LA	C	300,000
ST-19	DISTRIBUTED MEDICAL IMAGE PROCESSING NETWORK	HOWARD U	C	300,000
ST-19	IWARP PARALLEL COMPUTING ARCHITECTURE	LANL	N	300,000
ST-19	TECHNICAL SUPPORT	ESD	IH	296,503
ST-19	GIGABIT LOCAL AREA NETWORK DEVELOPMENT	USC ISI	C	295,641
ST-19	EROS PARTICIPATION IN MAGIC NETWORK R&D	USGS	IH	294,000
ST-19	HIGH-SPEED NETWORK PERFORMANCE TESTING	GTE PRODUCTS	C	270,000
ST-19	DELTA PROTOTYPE COMPUTING	CAL TECH	C	250,000
ST-19	GIGABIT LAN AND APPLICATIONS	GTE LABS	C	250,000
ST-19	HIGH PERF COMPUTING AND COMMUNICATION VISUALIZATION	U ILLINOIS	N	250,000

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HPC EFFORTS FOR FY92 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-19	RESEARCH ON LINKING ELECTRONIC LIBRARIES OF SCIENCE	CNRI	C	250,000
ST-19	INTEGRATED CIRCUIT TECHNOLOGY FOR HPCC	PRC	N	242,760
ST-19	SCALABLE RELIABLE INPUT/OUTPUT	UC BERKELEY	C	242,022
ST-19	PPL CELL FOURTH YEAR OPTION	U UTAH	C	240,000
ST-19	PARALLEL VISION SOFTWARE LIBRARY	CMU	C	232,000
ST-19	JAPENESE TRANSLATION	NY U	N	229,970
ST-19	X-KERNEL FOR MACH	U ARIZONA	C	225,000
ST-19	COMMON FRAMEWORK FOR VERIFICATION AND COMPLEXITY	MIT	C	225,000
ST-19	HPCC TECHNICAL SUPPORT	NASA-DC	IH	225,000
ST-19	INTERDISCIPLINARY RESEARCH PROGRAM	JACKSON ST U	C	207,240
ST-19	COMPUTER TECHNOLOGY DEVELOPMENTS	ATI	N	201,213
ST-19	INTELLIGENCE IN SCIENTIFIC COMPUTING	MIT	C	200,000
ST-19	TECHNICAL SUPPORT	MERIDIAN CORP	C	200,000
ST-19	IMAGE UNDERSTANDING ARCHITECTURE	HUGHES	C	200,000
ST-19	DEBUG TECH PARALLEL MULTITHREAD ARCHITECTURES	SANDIA	N	200,000
ST-19	NU-MESH	MIT	C	200,000
ST-19	SOFTWARE FOR SPARSE GRADIENT	U TEXAS	C	179,891
ST-19	INFRASTRUCTURE SUPPORT-HIGH PERF COMPUTING CENTERS	NSWC-IH	IH	176,651
ST-19	ACCESS TO FUTURE PBL SWITCHED NETWORK	U KANSAS	C	165,991
ST-19	TECHNICAL SUPPORT	AICS	IH	158,012
ST-19	INFORMATION SCIENCE AND TECHNOLOGY STUDY (ISAT)	IDA	N	150,000
ST-19	GNU-ADA9X COMPILER WORKSTATION & PARALLEL MACHINE	NY U	C	150,000
ST-19	ADVANCED CONCURRENT INTERFACES	MIT	C	138,704
ST-19	TECHNOLOGY SUPPORT FOR COMPUTING SAFEGUARDS PROGRAM	IDA	N	127,000
ST-19	WORKSHOP ON HIGH PERFORMANCE COMPUTING	NATL RESEARCH COUNCIL	N	120,000
ST-19	STRATEGIC COMPUTING INITIATIVE	AOT MARYLAND	C	120,000
ST-19	MICRO-MECHANICAL INFRASTRUCTURE	USC ISI	C	113,622
ST-19	DIGITAL SIGNATURE STANDARD	NIST	IH	110,400
ST-19	UNIFIED APPROACH TO OPTIMAL COMPUTING	U TEXAS	C	110,000
ST-19	IWARP/NECTAR	CMU	C	100,000
ST-19	IMAGE UNDERSTANDING ARCHITECTURE PROTOTYPE EVALUATION	U MASS	N	100,000
ST-19	COMPUTATIONAL ALGORITHMS FOR SCALABLE LIBRARIES	EXA CORP	C	100,000

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HPC EFFORTS FOR FY92 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-19	EVALUATION OF EARLY COMPUTING SYSTEM PROTOTYPES	CRAY RESEARCH	C	100,000
ST-19	MP-2 SIMD MACHINE EVALUATION	MASPAR COMPUTER CORP	C	100,000

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HPC EFFORTS FOR FY93 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-10	MCM FOUNDARY	E-SYSTEMS	C	2,929,000
ST-10	REAL-TIME INTERACTIVE SPOKEN LANGUAGE SYSTEMS	BBN	C	1,700,000
ST-10	SPOKEN LANGUAGE RECOGNITION AND UNDERSTAND	MIT	C	1,600,000
ST-10	MAUI FIBER OPTIC CONNECTION	AWARD PENDING	C	1,492,000
ST-10	3D DIAMOND MCM TECHNOLOGY DEVELOPMENT	E-SYSTEMS	C	1,301,100
ST-10	FAST FRAME 3D LASER IMAGER	ODETICS	C	1,300,000
ST-10	COMBINED LINGUISTIC AND STAT	SRI	C	1,271,000
ST-10	ADVANCED VEHICLE INTEGRATION	MARTIN MARIETTA	C	1,205,222
ST-10	HIPER-D/EMBEDDABLE HPC	INTEL CORP	C	1,000,000
ST-10	RAPID PROTOTYPE	AWARD PENDING	C	1,000,000
ST-10	IMAGE UNDERSTANDING ENVIRONMENT DEVELOPMENT	AWARD PENDING	C	962,500
ST-10	INTEGRATED FEASIBILITY DEMONSTRATION	BBN	C	958,648
ST-10	TECHNICAL SUPPORT	MERIDIAN CORP	C	937,426
ST-10	ROBOT SYSTEM DEVELOP & TESTING	CMU	C	911,769
ST-10	SMART VISION SENSORS	MIT	C	908,700
ST-10	RESEARCH IN INFO SCIENCE & TECHNOLOGY	COLUMBIA	C	900,000
ST-10	LARGE VOCABULARY CONTINUOUS SPEECH RECOGNITION	DRAGON SYSTEMS	C	900,000
ST-10	UNLIMITED-VOCABULARY DICTATION	CMU	C	900,000
ST-10	HIGH SPEED PACKAGING	MAYO FOUNDATION	C	850,000
ST-10	BASIC RESEARCH IN COMPUTER SCIENCE	CMU	C	815,849
ST-10	RADIUS RESEARCH	HUGHES RESEARCH LAB	C	812,000
ST-10	PACKAGING	TEXAS INSTRUMENTS	C	771,681
ST-10	DIGITAL SIGNAL PROCESSING ON MULTIPLE INDEPENDENT NODES	AWARE INC	C	710,552
ST-10	DECISION SUPPORT FOR TRANSPORT PLAN	SRI	C	702,000
ST-10	PARALLEL HIGH SPEED OPTICAL	MIT LINC LAB	N	655,000
ST-10	OPTICAL INTERCONNECT FOR MULTIPROCESSORS	WPI	C	646,613
ST-10	DISTRIBUTED ADA-A COMPILATION	VERDIX	C	623,088
ST-10	RESEARCH ON WIDE SPEC LANGUAGES	STANFORD	C	613,710
ST-10	INTELLIGENT SYSTEMS EVOLUTION	BBN	C	600,000
ST-10	DECISION THEORETIC APPROACH	ROCKWELL	C	600,000
ST-10	KNOWLEDGE BASED VISION TECHNIQUES	SRI	C	600,000

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HPC EFFORTS FOR FY93 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-10	VISION-BASED NAVIGATION & RECOGNITION	U MARYLAND	C	600,000
ST-10	HARDWARE TECHNOLOGY ROBUST PERSONAL COMMUNICATIONS TRANSCEIVER	UC LA	C	579,849
ST-10	RESEARCH ON SPOKEN LANGUAGE	CMU	C	535,677
ST-10	INTEGRATION OF OPTIMAL SCHED	GE	C	525,353
ST-10	ROBUST CONTINUOUS SPEECH RECOGNITION	BBN	C	500,000
ST-10	CONTRACT MANAGEMENT AND TECHNICAL SUPPORT	TACOM	IH	500,000
ST-10	EXPECT - BASIC RESEARCH IN ARTIFICIAL INTELLIGENCE	USC ISI	C	500,000
ST-10	TECH TRANSFER - HUMAN LANGUAGE TECHNOLOGY PROGRAM	AWARD PENDING	C	500,000
ST-10	ROBOTIC TECH TRANSFER SUPPORT	ARL-GOA	IH	488,000
ST-10	ROBUST CONCEPT SPOTTING	MIT LINC LAB	N	480,000
ST-10	UGV TECHNOLOGY INTEGRATION SUPPORT	MICOM	IH	475,000
ST-10	TAPS FOR CROSS-BAR SWITCH APPLICATIONS	MIT LINC LAB	C	466,389
ST-10	MATHEMATICAL LIBRARY SOFTWARE	PRINCETON	C	463,899
ST-10	INTEGRATED PCS TECHNOLOGIES	ISR	C	463,029
ST-10	MEMBRANE PROBE	HUGHES	C	461,000
ST-10	INFRASTRUCTURE - UBIQUITOUS COMPUTING	XEROX	C	458,316
ST-10	NIST WHISPER PROGRAM TASKS	NIST	IH	450,000
ST-10	LASER WRITE	MIT LINC LAB	N	450,000
ST-10	CARTOGRAPHIC MODEL ENVIRONMENT ENHANCEMENTS	GE	C	438,000
ST-10	DOMAIN EXPERTISE FOR KNOWLEDGE BASED PLANNING AND SCHEDULING	SRA CORP	C	417,792
ST-10	THREE CENTRAL PROBLEMS IN LARGE SCALE COMPUTATION	NIST	IH	400,000
ST-10	MULTI-DEM DATA COMPRESSION	STANFORD	C	400,000
ST-10	NANOMECHANICAL GENERIC SENSOR	CORNELL U	C	393,732
ST-10	HP SPEECH RECOGNITION/CONSISTENCY MOD	SRI	C	388,823
ST-10	DATA ANALYSIS & FMD SUPPORT	KPMG PEAT MARWICK	C	354,386
ST-10	HYBRID ACCESS SYSTEM HPCC TESTBED NETWORK	HYBRID	C	353,166
ST-10	VISUALIZATION AND MODELING FOR TRANSPORT PLAN	U MASS	C	349,718
ST-10	NONLINEAR SIGNAL PROCESSING TECHNOLOGY	U VIRGINIA	C	341,699
ST-10	DOMAIN EXPERTISE FOR KNOWLEDGE BASED PLANNING AND SCHEDULING	SRA CORP	C	329,048
ST-10	LOW K DIELECTRICS	GEORGIA TECH	C	325,000
ST-10	POWER-EFFICIENT COMPUTATION	MIT	C	324,100

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HPC EFFORTS FOR FY93 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-10	ROBUST, PORTABLE, AND SCALABLE LANGUAGE PROCESSORS	BBN	C	310,500
ST-10	UNIFIED THEORY OF DIST COMM COMP	STANFORD	C	300,579
ST-10	EVALUATION & DEVELOPMENT OF MULTIMEDIA NETWORKS	SRI	C	300,000
ST-10	TDM WITH OPTOELECTRICAL SWITCHES	NCCOSC	IH	300,000
ST-10	APPLYING STATISTICAL METHODS OF MACHINE TRANSLATIONS	IBM	C	300,000
ST-10	MODEL-BASED RECOGNITION OF OBJECTS IN COMPLEX SCENES	STANFORD	C	294,422
ST-10	TECHNOLOGY TRANSITION - SPECIAL HPC ENTERPRISE	AEROSPACE	N	280,000
ST-10	CASE BASED REASONING:	U MASS	C	279,691
ST-10	ENHANCED MISSION DEVELOPMENT AND EXECUTION	BBN	C	277,125
ST-10	OPTICAL INTERCONNECT	HONEYWELL	C	277,000
ST-10	HIGH K DIELECTRICS	RPI	C	274,371
ST-10	SUPPORT DARPA BASIC RESEARCH & HPCC PROGRAM	SPRINT	C	270,528
ST-10	ULTRA LOW POWER CIRCUIT TECH	JPL & LWL	N	260,000
ST-10	SERVICES & INFORMATION MANAGEMENT FOR DECISION SYSTEMS	USC ISI	C	260,000
ST-10	DATABASE INTERFACE FOR KNOWLEDGE BASED PLANNING	UNISYS	C	258,456
ST-10	SOLUTION OF EIGENPROBLEMS	ARGO NAT LAB	C	257,000
ST-10	COA ANALYSIS COMPONENT PROTOTYPE	ISX	C	255,345
ST-10	GEDAE FOR TESTBED NETWORK	GE AEROSPACE	C	254,567
ST-10	HIGH DENSITY PACKAGING	TEXAS INSTRUMENTS	C	250,478
ST-10	LOW COST, HIGH DENSITY LASER	BELL LABS	C	250,303
ST-10	PACKAGING FOR ELECTRONIC COMPONENTS	MAYO FOUNDATION	C	250,000
ST-10	LARGE SCALE FILING AND DATA MANAGEMENT	UC LA	C	250,000
ST-10	PERFORMANCE EVALUATION OF HIGH PERFORMANCE COMPUTERS	USC ISI	C	250,000
ST-10	AUTOMATED CARTOGRAPHIC FEATURE	CMU	C	250,000
ST-10	AUTOMATED SITE MODEL ACQUISITION	U MASS	C	250,000
ST-10	SITE-MODEL-BASED IMAGE REGISTRATION	U MARYLAND	C	250,000
ST-10	RESEARCH IN IMAGE UNDERSTANDING (RADIUS)	SRI	C	250,000
ST-10	SPECIAL HPC FACILITY SUPPORT IMPLEMENTATION PLAN	SAIC	N	250,000
ST-10	SHAPE BASED IMAGE RESTORATION	COGNITECH	C	249,786
ST-10	TRANSPORT PLANNING PROJECT SUPPORT	RL	IH	245,000
ST-10	MANUFACTURING RESEARCH TESTBED	NIST	IH	241,000

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HPC EFFORTS FOR FY93 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-10	RECONFIGURABLE OPTICAL INTEGRATION	INTEL CORP	C	240,000
ST-10	DISTRIBUTED REAL-TIME/MULTICAST APPLICATION	BBN	C	238,000
ST-10	HIGH SPEED TESTING	COLUMBIA U	C	233,546
ST-10	EXPERT SYSTEM FOR IMPLEMENTING HIGH PERFORMANCE ALGORITHMS	OHIO ST	C	230,643
ST-10	GENERIC TOOLS FOR TRANSPORT PLANNING	KESTREL INST	C	216,000
ST-10	PORTING OF THE DITOPS TO SUNS	CMU	N	212,941
ST-10	INFORMATION INTEGRATION AND INTERCHANGE	GEORGE MASON U	C	210,000
ST-10	PROTOTYPING FOR DARPA IMAGE UNDERSTANDING ENVIRONMENTS	GEORGIA TECH	C	206,850
ST-10	SMART SPATIAL LIGHT MODULATORS	UC SD	C	204,412
ST-10	NLU SYSTEM BENCHMARK	SAIC	N	200,000
ST-10	ADVANCED OPTOELECTRONIC DEVICE	ROCKWELL	C	200,000
ST-10	A PROTOTYPING ENVIRONMENT FOR REAL-TIME SYSTEMS	U ILLINOIS	C	200,000
ST-10	PERFORMANCE OF VISION ALGORITHMS	U WASHINGTON	C	200,000
ST-10	PERSISTENT STORAGE TECHNOLOGY	PARAMAX	C	200,000
ST-10	GENERALIZED CROSSBAR	OPTIVISION	C	192,800
ST-10	MIXED MODE MODULES RESEARCH	STRATEGIC ANALYSIS INC	C	189,557
ST-10	NUMERICAL ALGORITHMS FOR COMPRESSIVE TURBULENCE	BROWN U	C	189,447
ST-10	3D STEREO IMAGING	REVEO INC	C	180,000
ST-10	COMPUTING RESEARCH TECHNICAL SUPPORT	AWARD PENDING	C	180,000
ST-10	NOVEL TECHNOLOGIES	TACAN	C	179,483
ST-10	TEXT RETRIEVAL CONFERENCE	PRC	C	174,000
ST-10	LARGE COMPLEX NONLINEAR MANUFACTURING	BROWN U	C	165,383
ST-10	NLU SYSTEM BENCHMARK	NCCOSC	IH	180,000
ST-10	SELF CLOCKED STRUCTURES FOR LOW POWER SYSTEMS	STANFORD	C	158,286
ST-10	OPTOELECTRONIC TECH. ROADMAP	OIDA	C	150,000
ST-10	INTEGRATION OF TEMPORAL REASON	GE	C	150,000
ST-10	RADIO PROPAGATION PREDICTION	VPI	C	143,846
ST-10	TACTICAL PLAN FOR CONTROL OF AGV	ADS	C	142,337
ST-10	MASS SPECTROGRAPH ON A CHIP	WESTINGHOUSE	C	140,762
ST-10	RESEARCH ON KNOWLEDGE BASED TECHNOLOGY FOR ENGINEERING APPLICATION	STANFORD	C	140,447
ST-10	APPLICATION OF THE TENSOR	ST CLOUD ST	C	139,435

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HPC EFFORTS FOR FY93 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-10	MACHINE TRANSLATION	PRC	C	130,500
ST-10	CORRELATING STIMULUS & RESPONSE	NCCOSC	IH	130,000
ST-10	NIST TEXT RETRIEVAL	NIST	IH	125,382
ST-10	III-V EPITAXIAL LIFT-OFF PROCESS	KOPIN	C	125,000
ST-10	ADHESIVE CONNECTION	3M	C	124,367
ST-10	COMPUTING RESEARCH TECHNOLOGY SUPPORT	USC ISI	C	123,228
ST-10	NSA TECHNICAL SUPPORT - TIPSTER	NSA	IH	120,000
ST-10	ACTIVE MAP TECH: KEY TO NEXT C4I	RAND	N	110,000
ST-10	AIR CAMP PLANNING TOOL PROTOTYPE	ISX	C	108,425
ST-10	MITRE MANAGEMENT/TECH SUPPORT	MITRE	N	100,000
ST-10	TECHNICAL ASSISTANCE	BOOZ ALLEN	C	100,000
ST-10	TDM WITH OPTOELECTRIC SWITCHES	NASA-JPL	IH	100,000
ST-10	MACHINE LEARNING FOR MILITARY OPS	SRI	C	100,000
ST-10	INVARIENT METHODS FOR FUSING	LOCKHEED-MSC	C	100,000
ST-10	ARTIFICIAL INTELLIGENCE FOR THEATER COMMAND & CONTROL	KAPOS	N	100,000
ST-10	COMPETITION SENSITIVE AWARDS -ST-10	VARIOUS	C	5,969,981

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HPC EFFORTS FOR FY93 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-19	SCALABLE MULTIPLE RESEARCH PROTOTYPES	INTEL CORP	C	6,000,000
ST-19	MOSIS BROKER	USC ISI	C	4,728,943
ST-19	INTEGRATED MASSIVELY PARALLEL SUPERCOMPUTER	CRAY RESEARCH	C	4,500,000
ST-19	DISTRIBUTED OPERATING SYSTEM FOR HPC	OPEN SOFTWARE	C	4,015,233
ST-19	THE STAR T PROJECT	MIT	C	3,809,637
ST-19	RESEARCH ON LINKING ELECTRONIC LIBRARY OF SCIENCE	CNRI	C	2,950,000
ST-19	ADVANCED CONNECTION MACHINE	THINKING MACHINES	C	2,500,000
ST-19	VERY HIGH PERFORMANCE MIMD	TERA COMPUTER	C	2,000,000
ST-19	HETEROGENOUS DISTRIBUTED COMPUTING	WPI	C	2,000,000
ST-19	NETWORK-BASED MULTICOMPUTERS	CMU	C	1,983,250
ST-19	TMACH OPTION II	TRUSTED SYSTEMS	C	1,903,987
ST-19	TECHNOLOGY TRANSITION - SPECIAL HPC ENTERPRISE	MADEN TECH	N	1,887,423
ST-19	SCALABLE, GENERAL PURPOSE SHARED MEMORY	STANFORD	C	1,800,000
ST-19	BASIC ENGINEERING OPTION	TERA COMPUTER	C	1,750,000
ST-19	CERT COORDINATION CENTER	SOFTWARE ENG INST	C	1,722,428
ST-19	WAFER-SCALE TECHNOLOGY FOR STRATEGIC COMPUTING	MIT LINC LAB	C	1,664,000
ST-19	3D DIAMOND MCM TECH DEVELOPMENT	E-SYSTEMS	C	1,500,000
ST-19	DESIGN AND PROTOTYPE OF HARD REAL TIME SYSTEMS	UC BERKELEY	C	1,476,251
ST-19	NETWORK-BASED MULTICOMPUTERS	CMU	C	1,414,868
ST-19	EMBEDDED MILITARIZED TOUCHSTONE	HONEYWELL	C	1,404,637
ST-19	HIPER-D/EMBEDDABLE HPC	INTEL CORP	C	1,399,589
ST-19	SYSTEMS SUPPORT	CAC	C	1,357,747
ST-19	HIGH PERFORMANCE COMPUTING FACILITY	MADEN TECH	N	1,309,914
ST-19	INFOSEC FOR NETWORKED SYSTEMS	TRUSTED SYSTEMS	C	1,304,042
ST-19	ADVANCED HIGH PERF MODULES	MCC	C	1,271,000
ST-19	A REDESIGNED ISIS & META SYSTEM UNDER MACH	CORNELL	C	1,231,331
ST-19	SUBMICRON SYSTEMS ARCHITECTURE	CAL TECH	C	1,106,283
ST-19	ADVANCED PRODUCTION TECHNOLOGIES	USC ISI	C	1,100,000
ST-19	GROWABLE GIGABIT ATM SWITCH	AT&T TECH	C	1,095,023
ST-19	DISTRIBUTED OPERATING SYSTEM FOR HPC	OPEN SOFTWARE	C	1,087,294
ST-19	NSF GRAND CHALLENGE	VARIOUS	C	1,001,000

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HPC EFFORTS FOR FY93 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-19	SCIENTIFIC VISUALIZATION CONSORT	U UTAH	C	1,000,000
ST-19	PERFORMANCE EVALUATION OF HPSSL SCALABLE PARALLEL SUPERCOMPUTER	CORNELL	C	1,000,000
ST-19	DEPLOYMENT AND EVALUATION OF THE CONNECTION MACHINE	THINKING MACHINES	C	989,724
ST-19	EMBEDABLE VECTOR UNIT	MIT LINC LAB	N	949,246
ST-19	PARADIGMS FOR UNIVERSALITY	MIT	C	925,000
ST-19	SOFTWARE PROGRAM FOR PARALLEL SCIENCE PROGRAM	RICE U	C	913,262
ST-19	THE FOX PROJECT	CMU	C	900,000
ST-19	CERPASS	USC ISI	C	898,728
ST-19	FAST TECHNIQUES FOR AFFORDABILITY	USC ISI	N	801,248
ST-19	LARGE SCALE FILING & DATA MANAGEMENT	UC LA	C	800,000
ST-19	SCALABLE PARALLEL LIBRARY	U TENNESSEE	C	800,000
ST-19	COMPILER TECH/MASSIVE PARALLEL	YALE U	C	790,455
ST-19	NU-MESH PROJECT	MIT	C	789,990
ST-19	INFRASTRUCTURE COMPUTING ARCHITECTURE	USC ISI	C	750,000
ST-19	DELTA PROTOTYPE COMPUTING	CAL TECH	C	750,000
ST-19	COMPUTER TECHNOLOGY DEVELOPMENTS	PRC	C	750,000
ST-19	CERT COORDINATION CENTER	SOFTWARE ENG INST	C	737,881
ST-19	GIGABIT LOCAL ATM NETWORKS	BELLCORE	C	737,258
ST-19	COMPUTATIONAL MODELS, LANG., & COMPILERS FOR MASS. PAR. MACHINES	HARVARD	C	733,000
ST-19	TOUCHSTONE PROTOTYPE	INTEL CORP	C	700,000
ST-19	UNIFIED APPROACH TO OPTIMAL COMPUTING	U TEXAS	C	652,822
ST-19	COMPUTATIONAL ALGORITHMS FOR SCALABLE LIBRARIES	EXA CORP	C	650,000
ST-19	EVALUATION OF SCALABILITY OF KSR-1 FOR GRAND CHALLENGE APPLICATIONS	OAK RIDGE NATL LAB	IH	650,000
ST-19	INTELLIGENT FILE SYSTEMS FOR OBJ	MIT	C	634,416
ST-19	COMPUTER-INTEGRATED DESIGN & MANUFACTURE OF ADVANCED TECHNOLOGIES	MIT	C	623,724
ST-19	DISTRIBUTED ADA-A COMPILATION	VERDIX	C	623,088
ST-19	TMACH EVALUATION	NIST	IH	622,120
ST-19	ATM-BASED LOCAL AREA NETWORKS	XEROX PARC	C	621,315
ST-19	LANGUAGES, LIBRARIES & PERFORMANCE EVALUATION TOOL	INDIANA	C	616,579
ST-19	PPL CELL MATRIX BASED SYSTEM DESIGN	U UTAH	C	606,295
ST-19	COMPILING FOR SIMD AND MIMD	SYRACUSE	C	600,000

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HPC EFFORTS FOR FY93 (Projects ST-10 and ST-19)

Project	Title	Contractor	Competitive Status	Funds Committed
ST-19	COMPILER DEVELOP FOR IMAGE UNDERSTANDING	AMERINEX	C	350,000
ST-19	GNU-ADA9X COMPILER WORKSTATION & PARALLEL MULTICOMPUTER	NY U	C	350,000
ST-19	COMPUTING TECHNOLOGY SUPPORT	AWARD PENDING	C	350,000
ST-19	TECHNICAL SUPPORT	AICS	IH	342,160
ST-19	CAD FRAMEWORK AND TOOLS	USC	C	326,116
ST-19	SCALABLE RUNTIME SUPPORT SPARSE & ADAPT COMPUTATIONS	USRA	C	310,922
ST-19	NETWORK RESEARCH FOR MAGIC GIGABIT TESTBED	MINN SUPERCOMPUTER	C	310,000
ST-19	HARDWARE & SOFTWARE MIMD MEASUREMENT	NIST	IH	302,400
ST-19	HETEROGENOUS DISTRIBUTED COMPUTING	WPI	C	300,000
ST-19	MITRE MAGIC ACTS FNC SUPPORT	MITRE	N	299,411
ST-19	SYNTHESIS OF TIMING-CONSTRAINED	U WASHINGTON	C	296,953
ST-19	GIGABIT LOCAL AREA NETWORK DEVELOPMENT	USC ISI	C	296,319
ST-19	XNETLIB TASK DESCRIPTION	U TENNESSEE	C	290,602
ST-19	ATOMIC HOST INTERFACE	USC ISI	C	290,063
ST-19	JAPANESE INFORMATION SCIENCES PROJECT	NY U	C	288,375
ST-19	INTERNET NAMING AND DIRECTORY EXT	USC ISI	C	266,493
ST-19	SCAL & PROB FORTRAN 90D	SYRACUSE	C	266,038
ST-19	RESERVATION PROTOCOL (RSVP)	USC ISI	C	251,741
ST-19	DELTA PROTOTYPE COMPUTING	CAL TECH	C	250,000
ST-19	SAFEGUARD/AUDIT ANALYSIS	TRUSTED SYSTEMS	C	244,542
ST-19	SOFTWARE FOR SPARSE GRADIENT	U TEXAS	C	244,245
ST-19	RESEARCH ON LINK ELECTRONIC LIBRARY - UCB	CNRI	C	240,000
ST-19	PARALLEL VISION SOFTWARE LIBRARY	CMU	C	237,000
ST-19	SCALABLE, OPEN PERF ENVIRON/PS	U ILLINOIS	C	230,000
ST-19	X-KERNEL FOR MACH	U ARIZONA	C	225,000
ST-19	IWARP PARALLEL COMPUTING ARCHITECTURE	LANL	C	225,000
ST-19	MICOM TECH SUPPORT	MICOM	IH	210,000
ST-19	ACCESS TO FUTURE PBL SWITCHED NET	U KANSAS	C	201,301
ST-19	DEBUG TECHNIQUES FOR PARALLEL MULTITHREAD SYSTEMS	SANDIA	IH	200,000
ST-19	HIGH PERFORMANCE COMPUTING ENVIRONMENTS	SW OPTIONS	C	190,000
ST-19	HIGH-SPEED NETWORK PERF TESTING	GTE PRODUCTS	C	187,293

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ANTICIPATED HPC EFFORTS FOR FY94

Project	Title	Contractor	Competitive Status	Funds Programmed
ST-19	TRI-STAR DEVELOPMENT	INTEL CORP	C	8,000,000
ST-19	THE STAR T PROJECT	MIT	C	4,464,362
ST-19	INTEGRATED MASSIVELY PARALLEL SUPERCOMPUTER	CRAY RESEARCH	C	4,200,000
ST-19	DISTRIBUTED OPERATING SYSTEM FOR HPC	OPEN SOFTWARE	C	4,128,832
ST-19	MOSIS BROKER	USC ISI	C	3,596,992
ST-19	PERFORMANCE EVALUATION OF HPSSL SCALABLE PARALLEL SUPERCOMPUTER	CORNELL U	C	3,000,000
ST-19	HIPER-D PROGRAM DESCRIPTION	JHU-APL	N	2,825,000
ST-19	SOFTWARE SYSTEM SUPPORT FOR HPC	CMU	C	2,628,947
ST-19	RESEARCH ON LINKING ELECTRONIC LIBRARY OF SCIENCE	CNRI	C	2,600,000
ST-19	HIGH DENSITY PACKAGING	E-SYSTEMS	C	2,000,000
ST-19	VERY HIGH PERFORMANCE MIMD	TERA COMPUTER	C	2,000,000
ST-19	NSF GRAND CHALLENGE	VARIOUS	C	2,000,000
ST-19	GIGABIT VIRTUAL CONNECTION LANS	CMU	C	1,850,000
ST-19	THUNDER AND LIGHTNING: COMM NET	UC SB	C	1,849,140
ST-19	COMPUTER-INTEGRATED DESIGN & MANUFACTURE OF ADVANCED TECHNOLOGIES	MIT	C	1,645,815
ST-19	ADVANCED PRODUCTION TECHNOLOGIES	USC ISI	C	1,590,692
ST-19	THE FOX PROJECT	CMU	C	1,532,796
ST-19	BASIC ENGINEERING OPTION	TERA COMPUTER	C	1,500,000
ST-19	3D DIAMOND MCM TECHNOLOGY DEVELOPMENT	E-SYSTEMS	C	1,500,000
ST-19	GROWABLE GIGABIT ATM SWITCH	AT&T TECH	C	1,483,512
ST-19	LOW LATENCY, HIGH CAPACITY STORAGE SYSTEM	UC BERKELEY	C	1,386,128
ST-19	EMBEDDED MILITARIZED TOUCHSTONE	HONEYWELL	C	1,322,882
ST-19	DISTRIBUTED ADA-A COMPILER - SCALABLE ARCHITECTURE	VERDIX CORP	C	1,301,744
ST-19	DARPA/AEGIS HIPER-D EXPERIMENT	NAVSEA	IH	1,275,000
ST-19	SCALEABLE SHARED MEM MULTIPROCESSOR	STANFORD U	C	1,250,998
ST-19	ADVANCED HIGH PERFORMANCE MODULES	MCC	C	1,214,180
ST-19	DISTRIBUTED OPERATING SYSTEM FOR HPC	OPEN SOFTWARE	C	1,209,028
ST-19	MOSIS BROKER	USC ISI	C	1,200,000
ST-19	FAST TECHNIQUES FOR AFFORDABILITY	USC ISI	N	1,178,643
ST-19	AUTO-INDEX WIDE AREA FILE ACCESS	TRANSARC	C	1,150,339
ST-19	PARADIGMS FOR UNIVERSALITY	MIT	C	1,099,578

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Submitted to Comptroller 6/16/93

ANTICIPATED HPC EFFORTS FOR FY94

Project	Title	Contractor	Competitive Status	Funds Programmed
ST-19	RESEARCH IN NETWORK-BASED PARALLEL COMPUTERS	CMU	C	1,050,794
ST-19	HPC IN THE CURRICULUM	GEORGE MASON U	C	1,030,034
ST-19	HETEROGENEOUS DISTRIBUTED COMPUTING	WPI	C	1,019,368
ST-19	A REDESIGNED ISIS & META SYSTEM UNDER MACH	CORNELL U	C	1,018,261
ST-19	GIGABIT TESTBED EXTENSION	CNRI	C	1,000,000
ST-19	ATM-BASED LOCAL AREA NETWORKS	XEROX PARC	C	977,604
ST-19	SOFTWARE PLATFORM FOR PARALLEL SCIENTIFIC PROGRAMMING	RICE U	C	974,810
ST-19	NU-MESH	MIT	C	973,966
ST-19	WAFER-SCALE TECH FOR STRATEGIC COMPUTING	MIT LINC LAB	N	972,000
ST-19	MECHANISMS FOR ADVANCED MULTICOMPUTER	MIT	C	952,134
ST-19	SMART VISION SENSORS	MIT	C	914,567
ST-19	TBONE: TESTBED ALL-OPTICAL NET	MITRE	N	910,000
ST-19	NIMROD: SCALABLE INTERNET ARCHITECTURE	BBN	C	902,356
ST-19	INFOSEC FOR NETWORKED SYSTEMS	TRUSTED SYSTEMS	C	893,867
ST-19	HARDWARE TECHNOLOGY ROBUST PERSONAL COMMUNICATIONS TRANSCEIVER	UC LA	C	870,214
ST-19	ACTS/SUPERCOMP IN REMOTE, COOPERATIVE MEDICAL TRIAGE SUPPORT	U HAWAII	C	850,000
ST-19	COMPUTATIONAL MODELS, LANG., & COMPILERS FOR MASS. PAR. MACHINES	HARVARD U	C	787,000
ST-19	3D DIAMOND MCM TECHNOLOGY DEVELOPMENT	E-SYSTEMS	C	779,900
ST-19	PIXEL FLOW	U NORTH CAROLINA	N	756,271
ST-19	CAL TECH CONSORTIUM	CAL TECH	C	750,000
ST-19	SONET ENCRYPTOR	NSA	IH	750,000
ST-19	DIGITAL SIGNAL PROCESSING ON MULTIPLE INDEPENDENT NODES	AWARE INC	C	731,991
ST-19	TESTBED-OPTICAL NETWORKS(TBONE)	OPTIVISION	C	730,000
ST-19	ENGINEERING CHANGES TO EMBEDDED MILITARIZED TOUCHSTONE	HONEYWELL	C	715,000
ST-19	OPTIMIC: DISTRIBUTED SUPERCOMPUTER SUPERNET	UC LA	C	695,462
ST-19	UNIFIED APPROACH TO OPTIMAL COMPUTING	U TEXAS	C	686,655
ST-19	ALGORITHMIC SOLUTIONS TO PROBLEM	MIT	C	680,000
ST-19	INTELLIGENT FILE SYSTEMS FOR OBJ	MIT	C	677,327
ST-19	MIXED MODE MODULES	STRAT ANAL INC	C	671,768
ST-19	LARGE SCALE FILING & DATA MANAGEMENT	UC LA	C	653,764
ST-19	TRUST MACH DEVELOPMENT - EVALUATION	TRUSTED SYSTEMS	C	653,267

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ANTICIPATED HPC EFFORTS FOR FY94

Project	Title	Contractor	Competitive Status	Funds Programmed
ST-19	LANGUAGES, LIBRARIES, & PERFORMANCE EVALUATION TOOL	INDIANA U	C	646,322
ST-19	DEVELOPMENT OF GIGABIT ATM LAN PRODUCTS	FORE SYSTEMS INC	C	639,825
ST-19	NEW INTERNET SERVICES SCALABLE RESOURCE DISCOVERY	U COLORADO	C	586,460
ST-19	CERT COORDINATION CENTER	SOFT ENG INST	C	574,143
ST-19	NEW GENERATION PARALLEL COMPILER SYSTEM	U ILLINOIS	C	562,257
ST-19	SCALABLE RUNTIME SUPPORT SPARSE & ADAPTIVE COMPUTATIONS	USRA	C	555,761
ST-19	PARALLEL ADAPTIVE DEVICE SIMULATION	STANFORD U	C	549,787
ST-19	NATIONAL FELLOWSHIP	U MARYLAND	C	541,018
ST-19	HIGH PERFORMANCE COMPUTING ENVIRONMENTS	SOFTWARE OPTIONS	C	540,000
ST-19	EM ALGORITHM CONVERSTION TO PARALLEL MACH	MAYO FOUNDATION	Y	530,557
ST-19	NANOMECHANICAL GENERIC SENSOR	CORNELL U	C	524,186
ST-19	TRUST MACH DEVELOPMENT - OSF INTERACTION	TRUSTED SYSTEMS	C	516,335
ST-19	COMPILING FOR ADVANCED MICROPROCESSOR	RICE U	C	499,884
ST-19	OBJECT PARALLEL GRAPHICS FOR MULTICOMPUTERS	PRINCETON U	C	496,707
ST-19	NETWORK RESEARCH FOR MAGIC GIGABIT TESTBED	MINN SUPERCOMPUTER	C	482,573
ST-19	REAL-TIME TRAFFIC DISTRIBUTION IN HETEROGENEOUS ENVIRONMENTS	SRI	C	475,626
ST-19	HIGH PERF COMPUTING GRAPHICS	CMU	C	468,814
ST-19	ENHANCED COMPUTING SYSTEM PERFORMANCE AND RELIABILITY	NORTH CAROLINA A&T	C	461,841
ST-19	MAGIC TESTBED APPLICATION DEVELOPMENT AND RESEARCH	SRI	C	450,408
ST-19	DISTRIBUTED MEDICAL IMAGE PROCESSING NETWORK	HOWARD UNIV	C	450,000
ST-19	GIGABIT INTERNETWORK IMAGE SERVER SYSTEM	LBL	N	444,275
ST-19	JAPANESE INFORMATION SCIENCES PROJECT	NY U	C	433,229
ST-19	MATHEMATICAL LIBRARY SOFTWARE	PRINCETON U	C	432,317
ST-19	TBONE: TESTBED OPTICAL NETWORKS	TASC	C	430,000
ST-19	HARDWARE & SOFTWARE MIMD MEASURE	NIST	IH	419,500
ST-19	DISSEMINATION-ORIENTED COMMUNICATION SYSTEM	STANFORD U	C	418,502
ST-19	EXPLOITING LOCALITY OF REFERENCE	MIT	C	415,299
ST-19	COMPILER TECH/MASSIVE PARALLEL	YALE U	C	412,149
ST-19	PROTOTYPE ELECTRONIC COPYWRIGHT MANAGEMENT SYSTEM	CNRI	C	407,922
ST-19	SCALABLE IMAGE COMPUTING ENVIRONMENT	PIXAR	C	406,431
ST-19	HIGH PERFORMANCE COMPUTING ENTERPRISE	MADEN TECH	N	400,000

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ANTICIPATED HPC EFFORTS FOR FY94

Project	Title	Contractor	Competitive Status	Funds Programmed
ST-19	HIPER-D PROGRAM DESCRIPTION	JHU-APL	N	400,000
ST-19	ACTS/SONET - HIPPI HIGH PERFORMANCE NETWORK INTERFACE	LANL	N	395,000
ST-19	MANAGING PERSISTENT OBJECTS IN THREE-LEVEL STORAGE	UC BERKELEY	C	391,372
ST-19	SECURE, BILATERAL, REPLICATED DISTRIBUTED FILING	UC LA	C	387,398
ST-19	SYNTHESIS & VERIFICATIONFOR COMBINED SEQUENTIAL AND BEHAVIORAL LOGIC	U COLORADO	C	371,916
ST-19	ONLINE SIMULATION USING ACTS	OHIO ST U	C	355,035
ST-19	INTERDISCIPLINARY RESEARCH PROGRAM	JACKSON ST U	C	355,000
ST-19	WIRELESS COMMUNICATION IN HIGH PERF COMPUTING	CYLINK	C	347,327
ST-19	COMMON FRAMEWORK FOR VERIFICATION AND COMPLEXITY	MIT	C	341,013
ST-19	DECENTRALIZED NETWORK MANAGEMENT	COLUMBIA U	C	336,062
ST-19	EROS PARTICIPATION IN MAGIC NETWORK R&D	USGS	IH	320,000
ST-19	MARUTI - REAL TIME SYSTEMS	U MARYLAND	C	313,830
ST-19	MULTI-DEM DATA COMPRESSION	STANFORD U	C	300,530
ST-19	LARGE SCALE NONLINEAR PROGRAMMING	IBM	C	295,609
ST-19	RESERVATION PROTOCOL (RSVP)	USC ISI	C	291,574
ST-19	MASS SPECTROGRAPH ON A CHIP	WESTINGHOUSE	C	290,379
ST-19	BROADBAND ISDN DYNAMIC TRAFFIC	MCNC	C	288,570
ST-19	DSO DSRC SUPPORT - TRANSFER	CHAS EVANS	C	287,279
ST-19	SOFTWARE FOR SPARSE GRADIENT	U TEXAS	C	285,330
ST-19	XNETLIB TASK DESCRIPTION	U TENNESSEE	C	280,603
ST-19	FAST IMAGE CORRELATION VELOC.	UC SD	C	277,877
ST-19	SCALABLE, OPEN PERF ENVIRON/PS	U ILLINOIS	C	276,282
ST-19	RESEARCH IN COMPUTING SYSTEMS TECHNOLOGY: NETWORKING	AT&T TECH	C	275,155
ST-19	SOLUTION FOR EIGEN PROBLEMS	ARGO NAT LAB	N	273,000
ST-19	SYNTHESIS OF TIMING-CONSTRAINED	U WASH	C	270,857
ST-19	EFFECT USE MULTIPROCESSOR FOR HPN PROTOTYPE	U MASS	C	264,875
ST-19	RADIO PROPAGATION PREDICTION	VPI	C	250,000
ST-19	MULTICOMPUTER RESOURCE ALLOCATION ALGORITHMS	U ILLINOIS	C	249,154
ST-19	RESEARCH ON LINKING ELECTRONIC LIBRARIES - UCB	CNRI	C	240,000
ST-19	SUPPORT DARPA BASIC RESEARCH & HPCC PROGRAM	SPRINT	C	229,152
ST-19	ROBUST DISTRIBUTED SYSTEM FOR REAL TIME	UC SB	C	224,164

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ANTICIPATED HPC EFFORTS FOR FY94

Project	Title	Contractor	Competitive Status	Funds Programmed
ST-19	GNU-ADA9X COMPILER WORKSTATION & PARALLEL MULTICOMPUTER	NY U	C	222,607
ST-19	ENHANCED MISSION DEVELOPMENT AND EXECUTION	BBN	C	222,478
ST-19	SECURE ACCESS AND SERVICE PROTOTYPES	TRUSTED SYSTEMS	C	221,723
ST-19	ADVANCED SYSTEM PACKAGING SERVICES	USC ISI	C	206,858
ST-19	INFRASTRUCTURE - UBIQUITOUS COMPUTING	XEROX	C	204,853
ST-19	SCALABLE PARALLEL LIBRARY	U TENNESSEE	C	200,000
ST-19	ENGINEERING STUDIES FOR RAPID INSERTION OF EMB. MIL TOUCHSTONE	HONEYWELL	C	200,000
ST-19	ELECTRONIC LIBRARY SUPPORT	USC ISI	C	191,164
ST-19	STRATEGIC COMPUTING INITIATIVE	AOT MARYLAND	C	190,000
ST-19	SCALABLE AND PORTABLE FORTRAN 90D	SYRACUSE U	C	186,227
ST-19	X-KERNEL FOR MACH	U ARIZONA	C	185,562
ST-19	OBJECT ORIENTED C3I DISPLAY	SOFT ENG INST	N	175,000
ST-19	DARTNET RELATED R&D	LBL	N	170,000
ST-19	POWER-EFFICIENT COMPUTATION	MIT	C	167,200
ST-19	NUMERICAL ALGORITHMS FOR COMPRESSIVE TURBULENCE	BROWN U	C	162,638
ST-19	HPC SYSTEMS IN MATERIAL PROCESSING & DEVICE DEVELOPMENT	FLORIDA A&M UNIV	C	159,970
ST-19	HETEROGENEOUS DISTRIBUTED COMPUTING	WPI	C	158,741
ST-19	PARALLEL VISION SOFTWARE LIBRARY	CMU	C	156,700
ST-19	SCALABLE INTERNETWORKING	UC SANTA CRUZ	C	156,331
ST-19	ACCESS TO FUTURE PBL SWITCHED NET	U OF KANSAS	C	155,452
ST-19	ATM ROUTING AND FLOW CONTROL	NETEXPRESS INC	C	150,000
ST-19	COMPILING FOR SIMD AND MIMD	SYRACUSE U	C	150,000
ST-19	DECENTRALIZED NETWORK MANAGEMENT	AEROSPACE	C	149,000
ST-19	INVESTIGATION INTO PARALLEL ALGORITHMS FOR SYMMETRY	USC ISI	C	148,386
ST-19	EVOLVABLE INTERNET PROTOCOL ARCHITECTURE	BELLCORE	C	147,671
ST-19	NONLINEAR SIGNAL PROCESSING TECHNOLOGY	U VA	C	143,872
ST-19	APPLICATION OF NASA ACTS TO MEDICINE	MAYO FOUNDATION	C	141,460
ST-19	JACKS HALL	ARGO SYSTEMS	C	140,895
ST-19	NEXT GENERATION GIGABIT LOCAL LIGHTWAVE	UC DAVIS	C	1,35,597
ST-19	AFIT PROPOSAL ON PARALLEL SIMULATION	AFIT	IH	135,000
ST-19	IMNET	TASC	C	134,069

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ANTICIPATED HPC EFFORTS FOR FY94

Project	Title	Contractor	Competitive Status	Funds Programmed
ST-19	EXPERT SYSTEM FOR IMPLEMENTING HIGH PERFORMANCE ALGORITHMS	OHIO ST U	C	130,303
ST-19	OSPREY BULL	NSMA	IH	130,000
ST-19	UNIFIED THEORY OF DIST COMM COMP	STANFORD U	C	128,388
ST-19	SCALABLE, OPEN PERFORMANCE ENVIRONMENTS PARALLEL	U ILLINOIS	C	124,321
ST-19	HETEROGENEOUS DISTRIBUTED COMPUTING	WPI	C	123,157
ST-19	REPLICATION TO BUILD HIGH PERFORMANCE DISTRIBUTED SYSTEM	GEORGIA TECH	C	121,096
ST-19	SOFTWARE PLATFORM FOR PARALLEL SCIENTIFIC PROGRAMMING	RICE U	C	117,169
ST-19	CHIRP DIVERSITY RADAR METHODS	RAYTHEON	C	106,514
ST-19	FIELDING FOR HIGH PERFORMANCE CAD SYSTEMS	MAYO FOUNDATION	C	104,000
ST-19	LARGE COMPLEX NONLINEAR MANUFACTURING	BROWN U	C	102,711
ST-19	THREE CENTRAL PROBLEMS IN LARGE SCALE COMPUTATION	NIST	IH	100,000
ST-19	COMPETITION SENSITIVE - ST-19	VARIOUS	C	113,706,734

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[CLERK'S NOTE.—End of questions submitted for the record.]

Wednesday, April 28, 1993.

STRATEGIC DEFENSE INITIATIVE

WITNESS

MAJ. GEN. MALCOLM R. O'NEILL, USA, ACTING DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

Introduction

Mr. Murtha. The Committee will come to order. The Committee is pleased to welcome Major General Malcolm O'Neill, who is the Acting Director of the Strategic Defense Initiative Organization. The fiscal year 1994 budget requests about $3.8 billion for the Strategic Defense Initiative Organization, slightly more than the $3.7 billion appropriated last year. The new Administration has restructured the SDI program to emphasize theater defenses for our deployed troops, and ground-based rather than space-based protection for the United States.

The hearing is closed due to security considerations. Your full statement will be placed in the record. Please briefly summarize it for us now.

Summary Statement of General O'Neill

General O'Neill. I am submitting a change to my statement for the written record. I have handed out a set of vuegraphs which may be needed later, but I don't intend to talk to them right now.

Sir, our fiscal year 1994 program reflects priorities established by Secretary Aspin and is consistent with basic tenets of the Missile Defense Act of 1991 as amended by the fiscal year 1993 National Defense Authorization and Appropriations Acts.

The SDIO proposed program emphasizes acquisition of improved theater missile defense as a top priority. The development program for a Limited Nation Defense capability is our second priority. The space-based interceptor program has been recast from an acquisition to a technology base program and funding reduced significantly from previous plans.

Our fiscal year 1994 effort keeps theater missile defenses on the schedule demanded by the threat and endorsed in the fiscal year 1993 National Defense Authorization Act conference report. It slips the option for deployment of a limited national missile defense capability from 2002 to no sooner than 2004 and preserves options for potential adjustments that may flow from Secretary Aspin's Strategy and Policy Review.

The fiscal year 1994 budget submitted to Congress has been reduced by $2.5 billion or roughly 40 percent from the planned Bush budget. This action represents a major redirection by the new administration and is the minimum funding level needed by the Secretary to keep this outyear options alive.

Without full funding of the administration's fiscal year 1994 Ballistic Missile Defense—BMD—budget, the administration may be forced to eliminate options which may deny our Nation of either a significant increase in theater missile defense, the ability to defend our homeland against limited strategic attacks, or the technology development required to respond to threat evolution.

Mr. Chairman, that completes my opening statement. I am ready for your questions.

[The biography, statement and charts of General O'Neill follow:]

Major General Malcolm R. O'Neill
United States Army

Major General Malcolm R. O'Neill is the Acting Director of the Strategic Defense Initiative Organization (renamed the Ballistic Missile Defense Organization on May 13, 1993), Department of Defense, Washington, D.C.

Prior to his appointment as Acting Director, General O'Neill served as Deputy Director of the Strategic Defense Initiative Organization (SDIO). The general also served as the first Director of the Army Acquisition Corps, chartered to ensure a fully qualified civilian and military acquisition cadre for the Army. He also served as the Deputy for Program Assessment and International Cooperation, Office of the Assistant Secretary of the Army (Research, Development, and Acquisition), assisting in the management and execution of the Armys major hardware programs. He supervised all cooperative research and development programs and represented the Army at all NATO and Four Power international research and development fora.

He is the former Commander, U.S. Army Laboratory Command, the Army Materiel Command's (AMC) major subordinate command, managing the Armys seven corporate laboratories, the Adelphi Laboratory Center, and six Special Technology offices. Additionally, the general served as the AMC Deputy for planning and managing the Army materiel technology base, the Army Research Office and Field Assistance in Science and Technology program.

General O'Neill was previously Deputy Director for Programs and Systems and Director, Kinetic Energy Weapons, at SDIO. He was also Chief of Staff for the U.S. Army Missile Command (MICOM). He served as project manager for the Multiple Launch Rocket System at MICOM as well as the program manager for Strategic Fire Control Technology in the Defense Advanced Research Projects Agency; and the deputy program manager, NATO Patriot Management Office, Munich, Germany.

General O'Neill received a bachelor of science degree in physics from DePaul University and both a master of science degree and doctorate in physics from Rice University. His military education includes the Field Artillery Officer Basic Course, the Ordnance Officer Advanced Course, the Army Command and General Staff College, and the Army War College.

The general's awards and decorations include the Defense Distinguished Service Medal, the Defense Superior Service Medal, the Legion of Merit with three oak leaf clusters, the Bronze Star with the V device and three oak leaf clusters, the Meritorious Service Medal, the Air Medal, the Army Commendation Medal and the Purple Heart with oak leaf cluster. He also wears the Combat Infantryman Badge, the Parachutist Badge and the Ranger Tab.

General O'Neill and his wife, Judy, have two children, Bonnie and John. The general is a native of Chicago, Ill.

(Current as of May 1993)

TESTIMONY OF MAJOR GENERAL MALCOLM R. O'NEILL
ACTING DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION
BEFORE THE COMMITTEE ON APPROPRIATIONS
SUBCOMMITTEE ON DEFENSE
UNITED STATES HOUSE OF REPRESENTATIVES
APRIL 28, 1993

Thank you, Mr. Chairman and members of the Committee. It is an honor to be here as Acting SDIO Director to testify on the Department's ballistic missile defense (BMD) programs for fiscal year 1994.

Our fiscal year 1994 program reflects priorities established by Secretary Aspin and is consistent with basic tenets of the Missile Defense Act of 1991 as amended by the fiscal year 1993 National Defense Authorization and Appropriations Acts. The SDIO proposed program emphasizes acquisition of improved theater missile defense as a first priority. The development program for a Limited National Defense capability is our second priority. The space-based interceptor program has been recast from an acquisition to a technology base program and funding reduced significantly from previous plans. Our fiscal year 1994 effort keeps theater missile defenses on the schedule demanded by the threat and endorsed in the fiscal year 1993 National Defense Authorization Act conference report. It slips the option for deployment of a limited national missile defense capability from 2002 to no sooner than 2004 and preserves options for potential adjustments that may flow from Secretary Aspin's Strategy and Policy review.

This BMD review is scheduled for completion in late May. It will then be integrated with the broader Department of Defense Bottom-up Review and culminate in the form of new Defense Planning Guidance.

The Strategic Context

In outlining the administration's defense plan, the Secretary of Defense has indicated that the global proliferation of ballistic missile technology and weapons of mass destruction has become one of the most immediate and dangerous threats to U.S. national security in the post Cold War era. Today, more than a dozen countries have ballistic missiles, and more have programs in place to develop them. Many of these missiles could be armed with chemical, biological, and possibly nuclear warheads. Currently, more than 25 countries, many of them hostile to the United States and its allies, may possess or be developing such weapons--so-called weapons of mass destruction.

Today, Third World ballistic missile technologies pose a threat that is largely regional in character. However, the trend is clearly in the direction of systems of increasing range, lethality, and sophistication. According to recent testimony from CIA Director Woolsey, "After the turn of the century, some countries that are hostile to the United States might be able to acquire ballistic missiles that could threaten the continental United States." He went on to state that "over the next ten years we are likely to see several Third World countries at least establish the infrastructure and develop the technical knowledge that is necessary to undertake ICBM and space launch vehicle development." He also warned, however, that such countries could truncate this development period through the acquisition of key production technologies and technical expertise or by covertly purchasing such systems.

The administration is also concerned with the threat posed by the presence of thousands of nuclear, biological, and chemical weapons in the former Soviet Union. The ongoing political and economic turmoil contributes to the possible spread of formerly Soviet weapons and weapons-making knowledge to potentially hostile regimes, while the dramatic political changes could betray weaknesses in Moscow's command and control system for their nuclear forces that neither we nor the Russians could have anticipated.

In addition to the threat posed by the proliferation of ballistic missile technology and weapons of mass destruction, Secretary Aspin has spoken of the dangers of regional conflicts, which have become a principal military concern since the collapse of the Soviet Union. Compounding this danger is the demonstrated likelihood that ballistic missiles will be used in future regional conflicts as they were most recently during the Persian Gulf War where Iraq launched nearly 90 Scuds against Israel and Saudi Arabia.

To address these dangers, the Administration plans to pursue a variety of initiatives. As the Secretary indicated in his testimony on the fiscal year 1994 budget, these include intensified efforts to halt proliferation; efforts to assist denuclearization in the former Soviet Union; maintaining strong nuclear forces for deterrence; and upgraded ballistic missile defenses via a refocused SDI program.

Theater Missile Defense Initiative (TMDI)

Consistent with the fiscal year 1993 Defense Authorization Conference Report, and as stated in the January 1993 SDI Report to Congress, the Director, SDIO, has been assigned management responsibility for both TMDI and SDI programs so that those activities can be "closely coordinated, including the use of combined or joint funding and management."

The highest program priority is Theater Missile Defense (TMD) in recognition of an existing threat, the Defense

Department's focus on regional conflicts, and our experience in Desert Storm. In response to the Secretary's direction, the Missile Defense Act of 1991 (MDA), and fiscal year 1993 congressional guidance, we are developing Theater Missile Defense (TMD) systems to protect U.S. forces deployed abroad and our friends and allies.

The TMD program has been expanded in the past year to reflect the transition from research and development to acquisition of TMD systems, and constitutes almost one-half of the budget request for ballistic missile defense. Funding will go from $1.1 billion appropriated in fiscal year 1993 to $1.8 billion requested for fiscal year 1994. Dynamics of the tactical/theater missile defense operations require us to develop upper and lower tiers of defenses in order to obtain the very high levels of protection required by the user. Thus, our funding request supports options in both tiers to include missile defense upgrades of existing ground and sea-based air defense systems like Patriot and Aegis and development of new active defense systems like THAAD.

The most important near term focus of the TMDI is the addition of missile defense capability to systems which have already been developed and fielded. By providing a missile defense product improvement, such systems as Patriot, Hawk, and Aegis can become more effective defensive weapons against tactical ballistic missiles in theater. And as the threat of ballistic missile attack in theaters around the world grows, America's sizable former years investment (10's of $B) in these systems can be made to pay off handsomely by a relatively small additional investment. Already manned with trained, highly motivated technical crews and possessing significant potential for improvements in hardware and software performance, these systems will form the foundation of the first generation of theater missile defenses.

Our approach is to improve and upgrade existing capabilities and also move as quickly as possible to develop advanced wide-area theater missile defenses that could be deployed on a contingency basis in the mid-1990s. Our fundamental system architecture creates an upper-tier TMD system to intercept theater ballistic missiles at high altitudes, far away from intended targets, and a lower-tier system capable of handling short-range missiles that either are not intercepted by the upper tier or underfly the upper tier. In addition, we are also evaluating concepts and technologies to intercept tactical missiles early in their flight. The task of the TMDI is to acquire only those systems that meet military requirements, are affordable and cost-effective.

For the near-term (fiscal year 1993-95), we have begun efforts to provide a quick-response upgrade to the PAC-2 Patriot

System that was used during Desert Storm, improving its range, coverage, and lethality. Upgrades to the Marine Corps Hawk air defense system to give it a limited anti-ballistic missile capability are also programmed. Additional efforts are being made to improve the processing and dissemination of launch detection data.

For the mid-term (fiscal year 1996-99), we propose additional Patriot upgrades that could lead to the PAC-3 configuration, which could include development of an improved version of the Patriot missile, with the ERINT hit-to-kill technology as a possible alternative munition for the Patriot System. Also, a sea-based ballistic missile defense system utilizing Aegis cruisers and destroyers, the Navy's existing Vertical Launching System (VLS), and a modified Standard Missile to defend ports, coastal airfields, and amphibious operations is being evaluated. Advantages of maritime TMD include the ability to arrive early in a crisis and remain on station in international waters in order to deter or frustrate a threatened attack.

Also in the mid-term, and to move beyond the inherent limitations of a lower-tier system, wide-area or upper-tier coverage using the Theater High Altitude Area Defense (THAAD) system (interceptor and TMD-ground based radar) could be added. By way of comparison, the defensive coverage against a Scud-like missile threat afforded by THAAD would be ten times that of the Patriot employed in Desert Storm and four times that of the planned PAC-3 Patriot improvement, and the intercepts would be made much further away from the intended target. The Department is responsive to the Missile Defense Act mandate for development of advanced TMD systems and the fiscal year 1993 authorization conferees' endorsement of SDIO's THAAD acquisition strategy. A prototype THAAD battery, or user operational evaluation system (UOES), can be provided at the end of the Demonstration and Validation phase as early as 1996 for early operational assessment and possible deployment if a contingency arises. Provision of the UOES is a major thrust and priority of the TMDI program.

In the far-term (fiscal year 2000+) the availability of space-based sensors, such as Brilliant Eyes, for missile tracking can significantly enhance the coverage of both lower and upper tier theater missile defenses, extending the range of THAAD and Navy wide-area interceptors, by providing accurate and early midcourse cueing.

Additional TMD capabilities could be added in the form of the shorter-range Corps SAM, which would be optimized for protection of fast moving, forward elements of the Army and Marine Corps combat force. Boost phase interceptors, which destroy missiles as they leave the launch pad relatively slow and bright, could also potentially be added. Intercepting in the boost phase has the added benefit that those missiles and their payloads could fall on enemy terrain.

Defense of the United States

The National Missile Defense (NMD) program has been modified to reflect a second priority relative to TMD. Fiscal Year 1994 funding is established at $1.2 billion. The bulk of this program is supported under the Limited Defense System Program Element, which constitutes almost one-third of the BMD budget request. Currently, the United States does not have active defenses against limited ballistic missile attacks. The budget submission establishes a program that, by accommodating required supporting technology and structuring a sufficiently robust test program, retains the option of developing for deployment an ABM Treaty-compliant defense of the continental United States in 2004. While the fiscal year 1994 budget request preserves the option to conduct an NMD program with low-to-moderate technical risk, the deployment date is ultimately contingent on increased levels of outyear funding.

The NMD baseline option supports system engineering activities; development of the Ground-Based Interceptor (GBI), the Ground-Based Radar (GBR), a command and control element, a space-based sensor, Brilliant Eyes (partially supported in the TMDI element), and the technology and testing necessary to support system development. Additionally, a key objective of the fiscal year 1994 NMD development strategy is to support essential technology programs to reduce risk in development activities and to hedge against future uncertainties.

Brilliant Eyes is supported in both LDS and TMDI because of its critical support to both elements. For NMD, Brilliant Eyes would provide the essential over the horizon track of incoming RVs which enables early commit of the GBI interceptors to provide full coverage of the continental United States. For TMD, Brilliant Eyes would maximize the defended area of the upper tier interceptors against the longer range theater threats and would provide a robust alternative source of target track data minimizing the effect of radar countermeasures.

The defensive coverage afforded by an ABM treaty-compliant system will, of course, vary with scenario and architecture. Against long range threats from a generally northerly direction, a single site of ground-based interceptors in North Dakota has the kinematic reach to protect the entire continental United States. This includes coverage against limited strikes from China, the former Soviet Union, including bastion-based submarines, and anywhere in the Middle East. Key to this coverage is the inclusion in the architecture of a sensor system which can provide over-the-horizon track data on the incoming reentry vehicles. This coverage would be provided by the Brilliant Eyes satellite system. In the program presented to Congress in July 1992 responding to the requirement for a mid-decade initial deployment, interim alternatives for this over-the-horizon coverage had to be considered, since the Brilliant Eyes could not be available on this schedule. These included the Ground-based Surveillance and Tracking System (GSTS) and software upgrades to the forward-based early warning radars. However, since the initial deployment has been slipped into the next decade, interim alternatives are no longer necessary. The Administration has yet to make a decision regarding treaty compliance of any of these sensor systems.

As noted by Secretary Aspin in his confirmation hearing before the Senate Armed Services Committee, to obtain full coverage of the entire United States, to include Alaska and Hawaii, additional ground-based interceptor sites that are presently prohibited by the 1972 ABM treaty will be required.

Follow-On Technology (F/O)

The proposed Follow-On Technology Program Element (PE) is a newly combined PE, taking projects from the Space-Based Interceptor (SBI) PE, which has been zeroed, and combining them with projects from the Other Follow-On PE. This PE supports two categories of activities.

The first category supports directed energy systems development. These defensive weapons would provide significant added capabilities for countering potential future threats that may very well increase in both number and sophistication. SDIO is responsible for a major share of the nation's directed energy--laser and particle beam--research and development efforts. SDIO's fiscal year 1994 directed energy investment is substantially lower than in previous years but will protect key portions of the directed energy infrastructure. In response to fiscal year 1993 congressional language, two far-term follow-on directed energy programs--the Free Electron Laser and the Airborne Laser--have been transferred from SDIO to the Services.

The second category is other Advanced Technologies, such as very advanced interceptors, sensors, materials, power technologies, and some near term demonstrations of future capabilities. The Brilliant Pebbles program has been moved to this PE and is funded at $73M. Because of budget reductions, these activities have been reduced to supporting only a few of the highest payoff technology areas.

Research and Support (R&S)

The Research and Support PE essentially contains two categories of activities: "Research" and "Support" for activities in one or more of the other program elements. The fiscal year 1994 budget request for this PE is $360.9M, and when combined with the Follow-On PE constitute about one-fifth of the overall BMD budget request. In order to maintain essential activities supporting the priority TMD and NMD programs and to live within prior year congressionally-imposed ceilings on the funding within this program element, all of the test and evaluation and simulation activities have been divided, sometimes reduced, and moved to the program elements they directly support.

Research activities in the R&S PE are primarily associated with Innovative Science and Technology (IS&T), and our technology transfer and technology commercialization work. In previous years, this area also contained Small Business Innovative Research (SBIR) programs; but in fiscal year 1994, SBIR will be a separate program element. This PE also includes our technical work done to integrate all threat and countermeasures work conducted in support of system development activities.

Under our Support activities, we supply the basic management support to SDIO and our executing agents across the nation. These functions form a vital part of assuring our overall program viability. Here we pay for salaries, capital equipment, and basic management support within SDIO and within the executing Services and Agencies. Note that SDIO spends more than five times as much on salaries for Service agents as it spends on SDIO salaries.

Management Issues

SDIO management of the Department's ballistic missile defense activities serves to involve all the Military Services and war fighting Commanders in Chief in the process of developing missile defenses and assures that their efforts are integrated into a coherent, cost-effective program that produces a truly joint Service missile defense system.

In accordance with a Memorandum of Agreement between SDIO and the Services in the spring of 1992, a streamlined SDIO acquisition structure has been established utilizing Service-appointed Program Executive Officers (PEOs) working acquisition matters with an SDIO official designated as BMD General Manager (GM). Reporting to the GM is the Assistant General Manager for National Missile Defense and the Assistant General Manager for Theater Defense, who has been designated as the SDIO official responsible for execution of the Theater Missile Defense Initiative.

A very important part of this new acquisition structure is the appointment of the Service PEOs at the two-star general/flag officer level. They are responsible for execution of Service Program Management Agreements and for providing guidance and Service-related direction to subordinate program managers. The PEOs have further enhanced our working relationships and flow of information between the Services and SDIO to ensure a coordinated effort leading to satisfactory completion of assigned programs.

Under the GM concept, I believe we have realigned our management structure to effectively integrate Service capabilities and requirements with SDIO oversight and integration responsibilities.

Conclusion

The fiscal year 1994 budget submitted to Congress has been reduced by $2.5B or roughly 40 percent from the planned Bush budget. This action represents a major redirection by the new administration and is the minimum funding level needed by the Secretary to keep his outyear options alive. Without full funding of the administration's fiscal year 1994 BMD budget, the administration may be forced to eliminate options which may deny our nation of either a major increase in theater missile defense, the ability to defend our homeland against limited strategic attacks, or the technology development required to respond to threat evolution.

Mr. Chairman, that completes my opening statement. I'm ready for your questions.

STRATEGIC DEFENSE INITIATIVE

Information For The
Committee On Appropriations
Subcommittee On Defense
House Of Representatives

28 APR 93
MG Malcolm O'Neill, USA
Director (Acting)
Strategic Defense Initiative Organization

jm-34566 / 042293

THE BALLISTIC MISSILE THREAT TO THE UNITED STATES

- "...Now We Don't Have Any Evidence To Suggest That Any Country Currently Plans To Bring Together The Materials, Technologies, And Facilities, And Expertise, But After The Turn Of The Century, Some Countries That Are Hostile To The United States Might Be Able To Acquire Ballistic Missiles That Could Threaten The Continental United States. *We Can't Give You A Precise Date -- Whether It's Eight Years Or Ten Years Or Fifteen Years From Now* -- By Which That Might Occur."

- "...But I Think I Should Say That Over The Next Ten Years We're Likely To See Several Third World Countries At Least Establish The Infrastructure And Develop The Technical Knowledge That's Necessary To Undertake ICBM And Space Launch Vehicle Development. *A Shortcut Approach That's Prohibited By The Missile Technology Control Regime And By The Nonproliferation Treaty Would Be For Such Third World Countries To Buy ICBMs Or Major Components Covertly Together With Suitable Nuclear Warheads Or Fissile Materials.* Anything Such As That Would, Of Course, Speed Up ICBM Acquisition By Such Nations."

James Woolsey
CIA Director
Before The Senate Governmental
Affairs Committee
February 24, 1993

jm-33141 / 031093

THIRD WORLD THREAT

"Our Missiles Cannot Reach Washington. If They Could Reach Washington, We Would Strike It If The Need Arose."

Saddam Hussein

"Did Not The Americans [In The Air Strikes On Tripoli And Benghazi] Almost Hit You... If They Know That You Have A Deterrent Force Capable Of Hitting The United States, They Would Not Be Able To Hit You. If We Had Possessed A Deterrent -- Missiles That Could Reach New York--We Would Have Hit It At The Same Moment. Consequently, We Should Build This Force So That They And Others Will No Longer Think About An Attack."

Col Muammar Qadhafi

RUSSIAN INTELLIGENCE REPORT ON PROLIFERATION

"...But It Is Already Obvious Now That The Departure From A Bipolar World In Military And Political Relations Not Only Did Not Eliminate, But Has Not Lessened The Possibility Of The Destabilization Of The International Situation On A Regional Level. *The Proliferation Of WMD -- Nuclear, Chemical, And Biological -- Constitutes A Particular Danger In This Connection.* Its Spreading, Like The Metastasis Of A Cancerous Tumor, Can Strike The Entire Fabric Of International Relations And Undermine Hopes For The Creation Of A Just And Stable World Order."

Ye. Primakov, Director Of The Foreign Intelligence Service Of The Russian Federation: "A New Challenge After The 'Cold War': The Proliferation Of Weapons Of Mass Destruction", Moscow 1993

jm-33364 / 030993

SECDEF ON THREATS TO NATIONAL SECURITY

	SDIO Contributions
• Regional Conflict	• Protect Forces For Power Projection And Relief Operations • Coalition Flexibility / Stability
• Danger To Democracy And Reform In The Former Soviet Union	• Cooperative R / D • Potential Multilateral Defense
• Economic Security Of The U.S.	• Dual Use Technologies • Advanced Technology Development - Aerospace - Electronics • Commercialization Of Military R&D
• Weapons Of Mass Destruction	• Support Effort To Halt Proliferation • Develop Improved Ballistic Missile Defense

SECDEF FY 94 GUIDANCE

- Strategic Defense Initiatives Programs
  - SDIO Funding Should Be Maintained At The FY 93 Nominal Level, Consistent With The Following Priorities
    - Theater Ballistic Missile Defense Programs Should Be Given Highest Priority And Should Be Pursued On A Prudent Event-oriented Schedule That Provides For Adequate Testing Prior To Committing To Major Deployments
    - National Missile Defenses Should Be Given Second Priority Relative To Theater Missile Defenses. The National Missile Defense Program Should Support Deployment Beginning No Earlier Than 2002 Of A Defensive Capability For The Continental United States
    - Brilliant Pebbles Funding Should Be Reduced To Support A Technology Base Program. Brilliant Eyes Developments Should Be Slowed Pending Further Review Of The Role Of This System In The Revised Ballistic Missile Defense Architecture And Its Contribution To Space Based Surveillance And Warning Of Ballistic Missile Attacks

RESPONSE TO SECDEF GUIDANCE

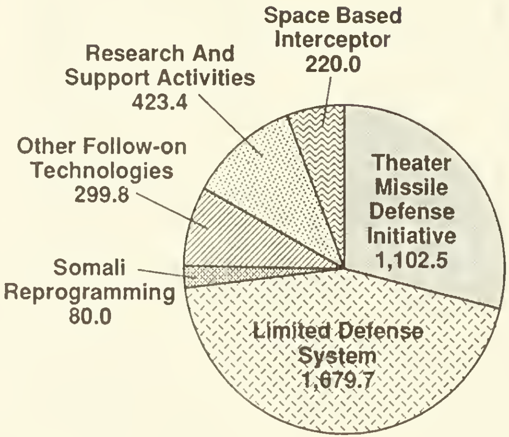
Theater	• Highest Priority • Event-oriented Schedule Providing For Adequate Testing • Increased Funding In FY 94 • Maintained FY 96 UOES THAAD / GBR Deployment
National	• Second Priority • Deployment Starts In 2004 • Defend Continential U.S. • Decreased Funding In FY 94
Space Based Interceptors	• Reduced To A Technology Base Program • Substantially Reduced Funding In FY 94

- Level Funded For FY 94, But Maintaining Options

SDIO BUDGET
BY PROGRAM ELEMENT

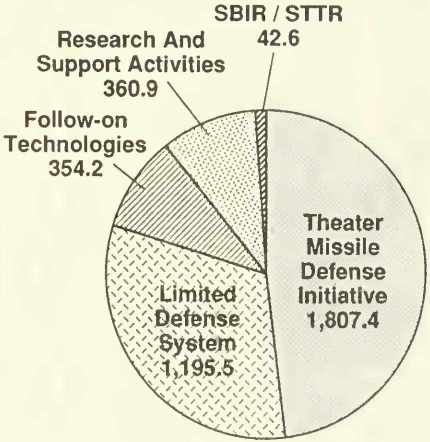
$ In Millions

FY 93 Appropriation



Total $3,805.4

FY 94 Request



Total $3,760.6

jm-34479a / 042293

Mr. MURTHA. When I make my speeches throughout the country, I say that the number one expenditure, if we didn't have money for anything else, would be a nuclear deterrent. I think that has worked very effectively over the years.

I am not sure that type of deterrent will work as effectively if someone develops a single warhead nuclear capability from a country that is fanatic—meaning Iran. I can't think of another country that would attack us and I know they understand when they attack it would cause massive retaliation. Obviously the initial strike would be deadly even if it is only one warhead, but to deploy a force would be very expensive and they would try to go someplace where we aren't.

Another thing I worry about as much as their firing is perhaps one of those 30,000 warheads in the Soviet Union being fired by somebody. Another is terrorism. We can't guard against it all.

We appreciate your concern about it. What do you see in making your analysis of how soon any country could develop that kind of capability outside of the countries that already have it?

General O'NEILL. My own opinion reflects Jim Woolsey, the Director of the CIA. If you look at the first—I can now call to your attention the handout—the first page of the handout is a quote from Jim Woolsey. If I may read from it: "We can't give you a precise date"—he is talking about when the rest of the world could be adversaries to the United States—"We can't give you a precise date, whether it is eight years or ten years or fifteen years from now, by which that might occur."

In the next paragraph, he talks about a scenario that you really can't put beyond the capability or inclination of some or our adversaries; that is, "A shortcut approach that is prohibited by the Missile Technology Control Regime and by the Nonproliferation Treaty would be for such Third World countries to buy ICBMs or major components covertly together with suitable nuclear warheads or missile materials."

So I am suggesting that if the first paragraph indicates 8 to 10 to 15 years, we have to start today because that is how long it takes us to build equipment. If it is earlier, then we are in for some interesting events in the future.

Mr. MURTHA. We are very familiar with the intelligence community. So you base your information on and give great credence to what they predict?

General O'NEILL. Yes, sir; I do.

Mr. MURTHA. I assume it has some output from you when you start talking about the technical problems?

General O'NEILL. Yes, sir. We have a representative, a senior intelligence service member in the SDIO on loan from Mr. Woolsey.

Mr. MURTHA. It is a tough call, and we are trying to make sure that we spend the money in the appropriate places as we go along. I will never forget, I was not enamored with SDI and I went to Russia and Mr. Gromyko spoke to us for a few minutes criticizing SDI, so I knew it must be worth something. Mr. McDade.

GLOBAL PROTECTION AGAINST LIMITED STRIKES (GPALS) CONCEPT

Mr. McDADE. Mr. Chairman, thank you very much.

General, welcome to the Committee. You have a lot of important work to do. We all know that the strategy for SDI has changed over the years, the current strategy being called GPALS. In layman's terms, describe the GPALS concept to us and tell us what it will accomplish.

General O'NEILL. The GPALS concept is a ballistic missile defense concept which is designed to protect globally against attacks of limited scope, up to about 200 reentry vehicles. The system is based upon three segments. The first is a global segment, which is a space-based defense layer. That space-based defense layer would attack the boosters as they rise from the enemy terrain. That would be the first tier of defense. The next tiers would depend upon whether the adversary is attacking the national U.S. homeland or attacking a theater.

In a theater, we have a series of systems that make up the segment we call theater missile defense, including maritime systems, ground-based systems, and air-based or space-based systems.

The national protection is provided by ground-based interceptors that are cued by space-based sensors. So there are three segments: global, national, and theater, and they together combine to provide global protection against limited strikes.

Mr. McDADE. Those are the same names as limited defense, theater defense, and follow-on?

General O'NEILL. Yes, sir. As a result of the guidance from the Secretary, we have placed the space-based interceptor area, the global area into the follow-on tech base regime. With that qualification, those are correct identifiers.

Mr. McDADE. That is the only way you get to the boost phase, isn't it?

General O'NEILL. Yes. For a strategic weapon, the concept now is to be in space.

However, in theater, if you have a system that can penetrate into the enemy rear, you might be able to do it from an airborne platform. So we are looking at airborne platforms, UAV platforms as well as space-based.

BRILLIANT PEBBLES

Mr. McDADE. Was the concept of Brilliant Pebbles deemphasized for funding reasons?

General O'NEILL. That is based largely upon the dialogue between the administration and Congress. It was the feeling of the administration that the priorities had to be high for theater missile defense because that was where there was an urgent present threat.

After exhausting the priorities and the needs for theater missile defense, we then looked at national defense as the next highest priority.

Brilliant Pebbles wound up in third place and there was an affordability issue which pushed it into the tech base. Affordability is the key issue.

PROGRAM MILESTONES

Mr. McDade. Can you meet the deployment goal for the limited defense system in the Missile Defense Act?

General O'Neill. The deployment goal is based upon our presentation last summer to the Congress where we suggested that for a low-to-moderate risk program, we could deploy in the year 2002.

We have since revised that prediction based upon the economics of the situation to be 2004, one of the principal reasons being it is going to take us longer to put together an integrating prime contractor to assemble this national missile defense system.

For that reason, the date now is 2004, representing a low-to-moderate schedule. If Congress insists on a 2002 timeframe, we would reassess the risk depending on what we need to do by 2002.

Mr. McDade. Would you summarize the key dates and events for the GPALS system?

General O'Neill. Milestone two (engineering manufacturing development for the national defense system is 1998). The first unit equipped—because as a developer, I really can't speak to initial operational capability—that is decided on by the user—but the first unit equipped for the national defense system would be 2004.

On the global side, that date has been postponed indefinitely, so I would rather not speak to a date for IOC for the global.

In theater, there are a series of dates. The Patriot will have its Milestone 4, which is the decision to make a major product improvement in early 1994. The Patriot units will be equipped in late 1997, early 1998. We will push as hard as we can to get into 1997 for Patriot and may slip into 1998.

The Navy's Aegis system, we are going to make a decision in 1994 to upgrade their lower tier capability, which is analogous to Patriot.

They will drive as hard as they can for capability in 1997. So for theater, you see an earlier maturation of systems than you would in the national defense.

SDI PROGRAMS TRANSFERRED TO THE SERVICES

Mr. McDade. We understand that some SDI programs have been transferred to the Army and Air Force in the new budget. Which ones and why are they transferred?

General O'Neill. In the language that came from Congress last year, we were directed to transfer programs that were defined as far-term follow-on. That means they are maturing at rates slow enough that they will mature beyond a 15-year spectrum of time.

Unless the Secretary states that those systems must be retained in SDI for national security reasons, those systems should be given to either ARPA or the Services for development.

We found two candidates which are successfully transitioned to the Services. The first was the airborne laser, which the Air Force is looking at for, among other things, boost phase intercept in the enemy rear where you can project a laser beam from the forward line of troops into the enemy rear.

The other is the free electron laser, which we transitioned to the Army.

Mr. **McDade**. For the record, put in their funding profile for fiscal year 1994 and the FYDP.

Thank you.

[The information follows:]

The following funding charts provides the FY 1994–FY 1999 funding profile for the AirBorne Laser (ABL) and the Free Election Laser (FEL), (at the time they were transitioned).

[Then year dollars in millions]

Program	Fiscal year					
	1994	1995	1996	1997	1998	1999
ABL	12.0	46.0	155.0	163.0	13.8	23.1
FEL	15.0	15.0	16.0	19.0	20.0	25.0

Mr. **Murtha**. Mr. Visclosky.

NAVY INITIATIVE

Mr. **Visclosky**. Thank you, Mr. Chairman.

The Navy has expressed interest in improving the Aegis system. What advantage is there to the United States to have a sea-based anti-tactical ballistic missile defense capability?

General **O'Neill**. Sir, in many scenarios the Navy is the first on the scene and until you have hostilities the Navy may be the only Service that is on the scene.

The Aegis platform is a $40 billion investment. It is very unfortunate to my mind that the Aegis had to lie there dormant in the middle of the Persian Gulf and not participate in the anti-ballistic missile battle.

For Mr. Murtha's information, we checked and found that, had Aegis been in position and had a capability for lower-tier protection, the Aegis could have engaged the Scud—the Scud that hit the Pennsylvania National Guardsmen was launched north of Basra and actually flew across a portion of the Persian Gulf enroute to Dhahran. For one reason or another, it wasn't picked up by the Patriot. Had we had Aegis in position, the Mobile Bay and the Leyte Gulf, two cruisers were routinely tracking the Scuds as they rose above Iraq and moved toward Saudi Arabia. They could do nothing about it.

Here is a $40 billion platform which has as its mission defense of the fleet, defense of the amphibious force, defense of the littoral against air attack, and it is incapable of providing that mission. We want to, at significantly less investment, give that system a modicum of capability.

Mr. **Visclosky**. What is it capable of doing?

General **O'Neill**. The cruiser is the principal offensive weapon for the fleet in a tactical engagement. It provides air defense of the fleet, using the Standard Missile which can go after every air-breathing threat now. It launches the Tomahawk so it can do offensive strikes deep in the enemy rear and it successfully launched Tomahawks into the area of Iraq during the war.

It is the best anti-submarine warfare weapon we have. It has its own indigenous helicopters that fly out, drop Sonobuoys, find submarines.

I was on the——

Mr. VISCLOSKY. So it has the ability, in terms of its weaponry, to bring down aircraft, not other missiles——

General O'NEILL. It has the Phalanx system, and it has capability against cruise missiles, what we call airbreathing threats which include fighters, bombers, cruise missiles, remotely-piloted vehicles. Its computer rejects a ballistic missile because it is moving too fast. It says that can't be an airplane so don't shoot at it.

Mr. VISCLOSKY. Technically, what would have to be done to the radar fire control system and the Standard Missile weapon system itself to provide the capability you need?

General O'NEILL. We would need to upgrade the software for the radar and fire control, and we would need to modify the missile. That is all.

Mr. VISCLOSKY. Will all of the Aegis ships eventually have the capability?

General O'NEILL. The intent of the Navy now is to upgrade all cruisers and Aegis destroyers, the Arleigh Burke class destroyers with the lower-tier capability.

They have not decided what they will do with the other option, a wide area system.

Mr. VISCLOSKY. Will they want to upgrade their Standard Missile or do they anticipate developing a new interceptor?

General O'NEILL. For the lower-tier protection, they will develop and upgrade the Standard Missile. They have already come up with a block designation, the Block 4 Alpha.

As far as what they will do beyond that, which is to look at a very wide area system, they are looking at the marinization of the THAAD, an Army system. They are looking at a new Navy missile or a Standard Missile rear end with a new front end based upon SDI technology called Light Exoatmosphere Projectile—LEAP. The Navy is doing a study of those options and a cost and operational effectiveness analysis will be completed about this time next year.

Mr. VISCLOSKY. Do you have an acquisition cost for the entire system?

General O'NEILL. My comptroller suggested I don't give you specific costs, but it is around $4 billion. I asked the Navy what it would cost. They said about 10 percent of the cost of the Aegis. That is 10 percent of $40 billion.

Mr. VISCLOSKY. Could you provide, for the record, a detailed description of the breakout and justification for the ATBM funds that the Navy has requested for 1994?

General O'NEILL. Yes, sir.

[The information follows:]

Sea-based assets can provide a significant contribution to Theater Ballistic Missile Defense (TBMD) objectives. Development of a sea-based TBMD capability takes advantage of the attributes of naval forces including overseas presence, mobility, flexibility, and sustainability in order to provide protection to debarkation ports, coastal airfields, amphibious objective areas, allied forces ashore, population centers and other high value sites. Additionally, in many cases, sea-based assets will provide the only means to establish an initial TBM defense for the insertion of additional land-based TBMD assets and other expeditionary forces in an opposed environment. The

Naval and Marine Corps TMD program is dependent upon receipt of the requested funding.

The BMDO-Navy TBMD Program has two distinct elements:

1. The AEGIS/SM-2 BLK IVA Program for Lower-Tier TBMD. Requested funding would provide:

Software modifications to the AEGIS weapon system ($32M); and

Warhead, seeker and fuze changes to the existing SM-2 BLK IV Missile to achieve the SM-2 BLK IV ($114M).

We expect that effort to give us DEM/VAL missiles with a contingency warfighting capability in the 1997 time frame.

2. Sea-based Theater Defense (Upper Tier) part of the program is funded at $94M for FY94. This funding amount provides:

Continuation of TERRIER LEAP flight tests ($35);
SM-2 BLK IV/LEAP start up ($25M);
THAAD compatibility work ($10M); and
System Engineering/COEA ($24M).

Mr. Visclosky. Thank you, Mr. Chairman.

Mr. Murtha. What would be the cost of the upgrade to have the capability of shooting down the Scud type missile?

General O'Neill. Sir, right now I would estimate that at about $1.5 billion, RDT&E, and acquisition of sufficient rounds, and I think that is about a thousand rounds. $1.5 billion.

Mr. Murtha. We need to thank Mr. Livingston for his efforts in this problem and the progress that has been made on this. Mr. Livingston.

Mr. Livingston. Thank you, Mr. Chairman. I hope we will follow through with that program. I appreciate your remarks.

THREAT TO U.S.

General, right now just the Soviets have the capability—or the old Soviets—the Russians, the Ukrainians, the Kazakstanis—just they have the capability of hitting the continental U.S. with an intercontinental ballistic missile, is that right?

General O'Neill. No, sir. The Chinese do, also.

Mr. Livingston. Five years out, who do you think might have that capability?

General O'Neill. Sir, I could only guess, but I would suggest that India, in addition.

Mr. Livingston. Ten years out?

General O'Neill. North Korea, potentially; Iraq, potentially; Iran, potentially; Libya, potentially; India, potentially; Pakistan.

Mr. Livingston. You have just named some fairly nasty customers there. If we went all out right now, when is the earliest that we would have the capability of shooting down an intercontinental ballistic missile so that we would avoid being hit in the continental U.S.?

General O'Neill. Around 1999, 2000, if we went all out.

Mr. Livingston. 1999 to 2000 before we have the capability of stopping any missile——

Mr. Murtha. Ballistic missile?

Mr. Livingston. Intercontinental ballistic missile.

If we go at a moderate pace, such as is currently being projected, when is the earliest that we could stop such a missile?

General O'Neill. 2004.

Mr. Livingston. Knowing how volatile this world is—this is a hypothetical question—but are these other people who are in the process of developing the offensive missiles going to wait around for us?

General O'NEILL. No, sir. I would like to call your attention to the next page of my handout. It has two important comments.

First is a comment from Saddam Hussein, and he said, "Our missiles cannot reach Washington. If they could reach Washington, we would strike it if the need arose." Muammar Qadhafi said, "Did not the Americans almost hit you? If they know that you have a deterrent force capable of hitting the United States, they would not be able to hit you. If we had possessed a deterrent—missiles that could reach New York—we would have hit it at the same moment. Consequently, we should build this force so that they and others will no longer think about an attack." So they are thinking about it, and I don't know exactly what they are doing about it. I know they have money.

COOPERATION WITH RUSSIA

Mr. LIVINGSTON. In the changing world, Russia not only becomes a prospective offensive utilizer of such a weapon, they could use a defense themselves, couldn't they?

General O'NEILL. Yes, sir.

Mr. LIVINGSTON. What do you think are the chances of working together with the Russians and providing a global or mutual defense?

General O'NEILL. The idea was suggested by President Yeltsin last year. There were some early meetings between his people, George Mamedov, the Deputy Foreign Minister, and our Dennis Ross from the State Department.

They looked at various and sundry approaches, including technology cooperation, (and we do have technology cooperation under way with Russia,) concepts for a global protection system, and then other ways to provide for nonproliferation as well as ballistic missile defense. If you can make sure the other person doesn't get the ballistic missile, then your problem isn't as acute. So those three prongs have been looked at.

ABM TREATY

The present administration is now in the process of looking at its strategy for working issues of the ABM Treaty and of working this potential issue with the Russians. Soon we will know what their approach is going to be.

Mr. LIVINGSTON. On the ABM Treaty, I have a number of questions to submit for the record.

Give us a breakdown for the record of your perception of the problems that we run into and how we might resolve those problems.

[The information follows:]

The Administration has begun a comprehensive examination of U.S. ballistic missile defense policy and objectives and related ABM Treaty issues. This review, which should be completed in the near future, will provide the basis for U.S. decision for ballistic missile defenses, including the need for ABM Treaty modifications, if any.

Mr. LIVINGSTON. Also, a couple of personal questions about the SDI which I would like to submit for the record.

[CLERK'S NOTE.—Questions submitted by Mr. Livingston and the answers thereto follow:]

ABM TREATY

Question. Last year DOD testified that some relaxation in ABM Treaty restraints are required to deploy any meaningful defense against strategic ballistic missiles, either space or ground based. Furthermore, DOD is beginning to examine the treaty implications of modern theater missile threats which may have more capabilities than older ICBM systems originally covered by the treaty. Please explain DOD concerns about adherence to the ABM Treaty.

Answer. The U.S. has begun a comprehensive examination of the U.S. ballistic missile defense policy and objectives and related ABM Treaty matters. This review, which should be completed in the near future, will provide the basis for U.S. decisions on our options for ballistic missile defenses, including the need for modification of the ABM Treaty, if any.

Question. What can you tell us about Administration proposals being discussed with entities of the former Soviet Union to relax the ABM Treaty?

Answer. The U.S. has begun a comprehensive examination of U.S. ballistic missile defense policy and objectives and related ABM Treaty issues. This review, which should be completed in the near future, will provide the basis for U.S. decisions on our options for ballistic missile defenses, including the need for modification of the ABM Treaty, if any.

Question. What does the last signed Presidential directive on SDI require you to do in terms of adherence to the "narrow" interpretation of the ABM treaty?

Answer. Under existing guidelines, the SDI Program is to be conducted under the so-called "narrow" interpretation of the ABM Treaty.

Question. Under your current funding plan, at what point does DoD first experience a potential problem with ABM compliance?

Answer. Presuming that we are to proceed at the currently planned pace, DoD will first experience a potential problem with the ABM Treaty itself in FY 1995. In this regard, we are planning to develop and deploy theater/tactical missile defense systems to counter the projected threat to our forces abroad and to our allies. Although the objective of the ABM Treaty is to limit defenses against strategic ballistic missiles and not to limit defenses against other types of ballistic missiles, there may be conflicts between the development and deployment of some of the theater/tactical missile defense systems under consideration. In addition, the U.S. has begun a comprehensive examination of U.S. ballistic missile defense policy and objectives and related ABM Treaty issues. This review, which should be completed in the near future, will provide the basis for U.S. decisions for ballistic missile defenses, including the need for ABM Treaty modification, if any. At the completion of this study, we will be able to provide a more accurate determination when DoD will first experience a potential problem with the ABM Treaty.

Question. Are there any funds requested in fiscal year 1994 for activities that would violate the ABM Treaty?

Answer. There are no funds requested.

PROCUREMENT OF SUPPORT SERVICES

Question. The Congress limited the amount of money the SDIO could spend for the procurement of support services in FY1993 to $135 million. Will SDIO stay within the $135 million limit?

Answer. Yes, BMDO has established appropriate procedures to ensure compliance with the legislation. All purchase requests, statements of work and task orders are reviewed to ensure the effort is properly categorized. The BMDO Financial Management Directorate has established program controls and accounting procedures to track the commitment and obligation of funds for these support services. The BMDO Contracts Directorate has segregated these costs by contract and by contract line item number.

Question. What operational and administrative effects has that legislation imposed on SDIO during FY1993?

Answer. The Ballistic Missile Defense Organization (BMDO) (formerly Strategic Defense Initiative Organization) has rigidly complied with this legislation. However, there have been adverse effects on the program. With responsibility for integrating missile defense systems and providing general oversight and accountability for all missile defense research, BMDO program managers perform independent analyses of projects executed by the Military Departments—sometimes with contractor technical assistance. In many cases those analyses have been delayed or curtailed in order to stay within the statute.

The ceiling has also forced BMDO to transfer functions, such as preparation of programmatic environmental impact statements and Red Team countermeasures analyses, to one of the Military Departments. BMDO staff has had the additional responsibility of assuring that the Services perform these tasks with full information and understanding of the overall DoD perspective.

The ceiling also caused disruption among contractors supporting BMDO. Significantly, small businesses and small disadvantaged businesses have felt impacts since support services contracts have proven to be an effective way for them to be involved in the BMD program.

Question. Do you see any need for the Congress to enact a similar ceiling in FY1994?

Answer. No. BMDO has instituted a strong system of training and controls to ensure that support contractors are properly managed and only Government people perform inherently governmental functions. However, this ceiling is administratively burdensome and would continue to adversely affect BMDO's ability to oversee and manage the program.

In the last session, Congress also enacted Government-wide legislation relating to government agency procurement of support services. This was enacted as a provision in the Department of Labor Appropriations Act. The legislation establishes a uniform definition of support services for all agencies and establishes Uniform Reporting Requirements. Because BMDO has instituted controls to assure proper management of support contracts, BMDO in FY1994 should be subjected only to legislation governing procurement of contractor support that applies to all Government agencies.

[CLERK'S NOTE.—End of questions submitted by Mr. Livingston.]

Mr. MURTHA. Mr. Hefner.

Mr. HEFNER. Thank you, Mr. Chairman.

CAPABILITY OF OTHER COUNTRIES

Just one question following along with Mr. Livingston. When he asked about countries that would have the capability within the next five to ten years, one of the first countries you mentioned was India. Do we have evidence that they are pursuing a missile of this type?

General O'NEILL. Yes, sir. The evidence is that they have exploded a nuclear weapon. The evidence is that they have a space-launch vehicle that they have developed, and we have comments that I can enter for the record from both military and administration, if you call it "administration" in India, personnel which suggest that India needs its own deterrent.

It is a major power, and if other major powers in the world have deterrents, some claim that India needs a deterrent.

Mr. HEFNER. What about the case of Iraq and Iran and Qadhafi? What kind of intelligence do we have that tells us how far along they are? Have they tested a missile?

General O'NEILL. Sir, the evidence right now would suggest they do not have that capability and it is a long way off.

Mr. HEFNER. I understand that, but what evidence do you have that they have a site for this type work? Do we have that?

General O'NEILL. I don't have the identification of a site. What I do have is the knowledge that when the IAEA went into Iraq to find out what they had been doing, they suggested that Iraq was within about a year of having a nuclear capability. Iraq has a 600-kilometer Scud. It is a big step from a 600-kilometer Scud to a 10,000-kilometer range ICBM, but it is doable, and the concern that many of us have is that vehicles like these are either on the market, can be placed on the market, or can be obtained if one has the resources to obtain them.

Mr. HEFNER. Where would one find these on the market?

General O'NEILL. They would be on the market as space-launch vehicles.

Mr. HEFNER. Could they come indirectly from the U.S.?

General O'NEILL. No, sir.

Mr. HEFNER. There would be no way for them to be rerouted through a third country?

General O'NEILL. I don't think so. We are very careful about the transfer of missile technologies.

Mr. HEFNER. Who would have that capability available for export?

General O'NEILL. The countries of the former Soviet Union come to mind. Any country that has a space-launch capability would come to mind.

The issue is buying something for peaceful purposes, purely peaceful purposes and then converting it to a military use.

Mr. Hefner. What former states of the Soviet Union would have that capability?

General O'Neill. Ukraine and Russia.

Mr. Hefner. They would be the only two?

General O'Neill. Possibly Kazakhstan. The leading ones would be Russia and Ukraine.

Mr. Hefner. Thank you, Mr. Chairman.

Mr. Murtha. Mr. Wilson.

INDIA DETERRENT

Mr. Wilson. Yes, Mr. Chairman. Thank you.

General, I missed Mr. Hefner's original question. What were you saying about India needing a deterrent?

General O'Neill. The issue was, what suggests that India will have at some time ICBM-capability systems? What I suggested was nuclear testing, space-launch capability, meaning they can throw payloads long distances, and statements from important Indian fora that they feel India needs a deterrent, needs its own deterrent.

own deterrent.

Mr. Wilson. And you agree?

General O'Neill. Yes, sir. I agree that they may be so inclined.

Mr. Wilson. Would you say that Pakistan also needs a deterrent?

General O'Neill. I would think that would be Pakistan's inclination.

Mr. Wilson. But if you agreed that India would need a deterrent, you would agree Pakistan needs a deterrent?

General O'Neill. I am suggesting that their perceptions would be whether or not they need one.

Mr. Wilson. You indicated that although neither is a signatory of the Nonproliferation Treaty, that India being a great power, it would be understandable——

General O'Neill. Not at all. The only reason I stated India was that I am not aware of people in Pakistan saying that we think we in Pakistan need a deterrent. I am not suggesting India needs one; I don't think they need a deterrent. I am suggesting I have read of Indian persons saying they need a deterrent.

Mr. Hefner. My question was, what would be the first country able to have such a missile? It would be India? That was my question—if you wanted to follow from there.

Mr. Wilson. My point is that I am not sure what the terminology is, but the signatories of the Nonproliferation Treaty, Britain, France, China, the Soviet Union, and the United States and any others would be in noncompliance, and I would not—I could not possibly let this pass without reminding you that India has said they would not sign a Nonproliferation Treaty. And that Pakistan has said that if India signed, they would sign before the ink was dry. You have a power struggle on the subcontinent.

General O'Neill. I am not an expert in that area.

EXTENDED RANGE INTERCEPTOR [ERINT]

Mr. Wilson. On ERINT, we have worked together and have always been able to resolve issues without any serious problem in the committee. In the SDIO program, what is the situation as far as the Navy is concerned with ERINT or with other antimissile missiles?

General O'Neill. Right now the Navy, sir, is looking at the upgrade of the Standard Missile to provide an equivalent capability, really a little bit better than Patriot, but at what we call a "low-tier capability," so that would be a capability against the SS–21 out to maybe the 1,000-kilometer-variety system. Altitude limits, 30 kilometers. Ranges out to 110 to 150 kilometers.

The Standard Missile Block IV, which the Navy is just bringing into the fleet, it is in engineering development now, is a very hot missile, very capable, a lot bigger than ERINT.

The Navy suggests they can put a multi-modeseeker on that system and do very credible theater ballistic missile defense.

So that is the leading candidate and that is the thing the Navy is going to go into a decision milestone for major product improvement—in 1994.

Mr. Wilson. Does that have SDI funding?

General O'Neill. Yes, sir. We are the principal source of upgrading for that system to provide theater defense capability. The Navy is funding the Block IV, which is an anti-airbreather system that gives improved protection to the fleet out to greater range, and the SDI is going to buy the front end and the software improvements to give it the capability to go after ballistic missiles.

Mr. Wilson. Are these the tactical anti-missiles—we have: PAC–III, ERINT, Arrow, and the Navy Standard Missile; is that it?

General O'Neill. We also have the Theater High Altitude Area Defense System, a wide-area system. We are also looking at, for the Navy, a wide-area analog of THAAD, and it could be THAAD or something else.

To get back to ERINT, there is nothing that would prevent ERINT from being launched from a Naval vessel. The Marine Corps is looking at ERINT for applications to the combat force. The Army and Marine Corps are both looking at ERINT as a potential munition to be worked on in the Corps Sam System, and ERINT and Patriot are right now in a comparative shoot-off to see which will be the munition to go into the advanced Patriot system.

Mr. Wilson. As far as you know, in your proposal and request currently before the committee, do we have any conflict or is everyone agreed where we are?

General O'Neill. I think the only conflict, sir, is what is in the future for ERINT, and what is the level of funding that is necessary to make sure ERINT is all it could be, and I think we are still dialoging with the Army and working with Dallas in that area.

Mr. Wilson. But the Army is just as interested in PAC–III?

General O'Neill. Well, the Army is interested in both. The Army is going right down the straight and narrow here. The Marines are interested in ERINT, the Army is interested in ERINT, and we are interested in ERINT, but it has got to compete on a level playing field with those systems.

Mr. Wilson. Absolutely. You talked about a possible Navy application for ERINT. Does PAC–III have a possible Naval application?

General O'Neill. We are not looking at PAC–III for a Naval application.

Mr. WILSON. But you are looking at ERINT for Naval application?

General O'NEILL. Right now, there is nothing to suggest that ERINT would not be compatible with maritime employment. I don't think it is high on the Navy's list. I would have to defer to Admiral Mitchell, who is the Navy program executive officer.

Mr. WILSON. Thank you.

Mr. MURTHA. Thank you very much, General. We will have other questions for the record.

The Committee adjourns until 10 o'clock tomorrow.

[CLERK'S NOTE.—Questions submitted by Mr. Dicks and the answers thereto follow:]

STRATEGIC DEFENSE INITIATIVE ORGANIZATION

Question. One of the more exciting concepts I've heard of for accomplishing early, low cost theater missile defense capability is to retrofit existing missile systems, such as the Aegis missile, as well as on the Air Force's SRAM missile with the Light Exo-Atmospheric Projectile, or LEAP technology. I think this proposal provides some very exciting capabilities.

It's my understanding that there was a very successful, solid fuel LEAP test last week. I think that this is really the safest option for these sea and air platforms. Can you explain the details of these propsoals that are being considered?

Answer. Several LEAP ATDs have been planned which exploit this high technology hardware retrofitted onto existing systems. These include the NAVY Aegis Upper Tier and Air Force SRAM/LEAP Ascent Phase Interceptor.

The Navy/LEAP Aegis Upper Tier ATD has two phases. The ongoing Terrier LEAP experiments are using the Terrier Weapons System to evaluate the ability of the Standard Missile Blk 3, modified with a LEAP to intercept a theater type ballistic missile. These early experiments will demonstrate the feasibility of LEAPs aboard Navy Standard Missiles [that could lead to a sea-based regional defense concept]. This test program culminates in an intercept in early FY1995. During phase two of the program, the modern AEGIS weapons system would be modified to accommodate the Standard Missile Blk 4 with a LEAP projectile. By the end of FY1997, and end-to-end technical demonstration of a prototype Upper Tier weapon system could be complete.

The three major elements of the proposed Air Force SRAM/LEAP ATD include the surveillance and track, BMC3, and the interceptor. Several options for surveillance and track are possible but for the near term an airborne optical sensor, such as Cobra Ball, could adequately perform the necessary function. The Joint Tactical Information Distribution System would be used as the basis for BMC3 to provide the necessary links between the surveillance platform, the launch aircraft, and the interceptor. In fact, the F–15, B–52 and the B–1 should all be capable of launching a SRAM-based interceptor and have significant integration legacy with the SRAM. Finally, the interceptor missile would consist of a SRAM-A retrofitted with an SDIO-developed LEAP. This upgrade would fit within the current outer mold line of the SRAM, reducing the complexity of the weapons platform integration challenges.

A SRAM/LEAP flight test program has been proposed that would culminate in the intercept of a theater type ballistic missile in a realistic scenario by the end of 1995. This end-to-end test would demonstrate all the critical functions necessary for defense of a contested theater. The timing and pace of these programs are dependent on the results of the "bottom up" review.

Question. In the Aerospace Daily this morning, the news report indicates that "SDIO is to cut at least one LEAP contractor from tactical applications." Can you elaborate on this news article for us?

Answer. Drastic reductions in the FY1994 budget for our technology programs force us to make difficult choices. Our 6-year $400 million investment in the LEAP program has resulted in dramatic advances in the state-of-the interceptor technology. Although we believe this investment was well spent, the significant reduction in research dollars has forced us to scale back the LEAP effort in FY1994. We currently believe that we will only be able to fund 2 of the current 3 LEAP contractors. Final decision, and decision criteria, will be decided after the conclusion of the bottom-up review.

[CLERK'S NOTE.—End of questions submitted by Mr. Dicks. Questions submitted by Mr. Sabo and the answers thereto follow.]

FY 94 STRATEGIC DEFENSE INITIATIVE ORGANIZATION BUDGET

Question. I understand the Secretary of Defense has issued a set of policy guidelines for the SDIO, one of which directed you to maintain the FY94 budget at the FY93 level. What is the final FY93 budget, after the reductions caused by the reprogramming directed to support operations in Somalia, and after the transfer of laser programs to the Army and Air Force?

Answer. The original FY 1993 budget as approved by Congress was $3,805.400 million. The reprogramming directed to support operations in Somalia was $80 million; this reduced the SDIO FY 1993 budget to $3,725.400 million. The Free Electron Laser and Air-Borne Laser programs are funded within SDIO in FY 1993 for a total of $14.232 and $13.958 million, respectively. Subtracting these totals from the FY 1993 SDIO budget of $3,725.400 million would lower the SDIO FY 1993 budget to $3,697.210 million.

The FY 1994 SDIO budget request is $3,760.581 million. This FY 1994 requested amount would purchase less goods and services than the $3,697.210 million FY 1993 SDIO budget due to the effects of inflation.

Question. Assuming Congress approves the FY94 budget, and you proceed with the policy guidelines and program decisions implicit in the budget, how much would SDIO be requesting for FY95 and out years?

Answer. The Secretary of Defense is conducting a Bottom-Up Review, currently in progress, to determine the ballistic missile defense program and total funding requirements for that program over the next five years. Those funding levels will not be available until after the Bottom-Up Review has been completed.

Question. How much of the FY94 request is for programs that are currently "on-hold" due to DOD's comprehensive policy review? Is any FY93 funding on hold because of this policy review?

Answer. None of the FY 1994 request is for programs that are currently "on-hold" due to DOD's comprehensive policy review. However, there are several SDIO acquisition programs that have contractual, programmatic, or treaty points that have to be met before those programs can proceed as planned. We expect that these points will be cleared up and programs allowed to proceed with FY 1994.

Question. If Congress and the President decided to take a billion dollars out of the FY95 budget, which of your programs would you recommend for reductions?

Answer. BMDO has already endured a $2.5 billion dollar reduction from the FY94 Bush budget request of $6.3 billion to the Clinton budget request of $3.8 billion. A further reduction of a billion dollars would reduce the FY94 budget to $2.8 billion. This level of funding would decimate BMDO.

Question. Conversely, if a decision was made to hold FY94–FY98 SDIO budgets to $3.8 billion annually, what would you recommend as a long-term SDIO research and procurement program?

Answer. Within the priority guidance set forth by Secretary Aspin, which places Theater Missile Defense at the highest priority, and Defense of the U.S. as second priority, the "Bottom-up" review process has structured several program options which are consistent with approximately flat funding. The final option selection will also be influenced by the ongoing NSC review of administration policy towards ballistic missile defenses scheduled for completion later this summer. Since the full strategy review has not been completed, it would be inappropriate to release details about these options, before the administration has made its selection of ballistic missile defense program strategy. The FY94 funding request is fully consistent with the Aspin priorities, and is essential to support any of the options.

STRATEGIC DEFENSE PROGRAMS

Question. Have you reviewed your follow-on technologies to determine which additional programs should be transferred to the services?

Answer. BMDO has reviewed the follow-on technologies program, but at this time, pending the outcome of the ongoing BMDO review by the SECDEF, we have not decided to transfer any programs beyond the two already transferred (the Free Electron Laser program and the majority of the Airborne Laser program). Examination of alternative management strategies for Follow-on technologies is part of the DoD BMDO review terms of reference.

Question. How did you determine that $75 million was the appropriate "technology base" funding level for the Brilliant Pebbles program? What is the minimum sustaining level for the program? What are you projecting for Brilliant Pebbles out-year funding?

Answer. The BP acquisition program was initiated in the 1990 with full scale development decision in late 1995. This program would have provided a fielded capability before the turn of the decade at a total cost of less than $15 billion. The current Administration directed BMDO to make the program a technology base effort rather than an acquisition program, this led to three major replans of the program over the last 24 months.

The FY94 $75 million amount was the direct result of an iterative process between BMDO and the Department and within BMDO itself. This process started with the establishment of the FY94 budgetary goal of $3.8 billion for BMDO and took into account DoD and Congressionally established BMD priorities, the Department's desire to refocus the program as a technology effort, and priorities within BMDO itself. The $75 million is the minimum sustaining level that will allow continuation of critical kinetic energy interceptor development and demonstration of several hundred million dollars worth of hardware that the program has acquired to date. This includes an intercept test and LWIR sensor experiment in FY94. Until such time as the Department's bottom-up review is completed, the program continues to plan for out-year funding at the same $75 million level.

Question. How does Brilliant Pebbles support the SDIO's first (theater missile defense) and second (limited national defense) priority objectives?

Answer. Space-based interceptors serve as an independent defensive layer that reinforces ground assets and hedges against the risk of any off-nominal performance of ground-based elements.

Theater Missile Defense (TMD): The primary advantage of a space-based interceptor system such as BP is that tailored regional coverage can be established quickly. Interceptors could be on-station, providing continuous coverage, within 48 hours of a decision to establish such a limited constellation. Such a capability is especially crucial where ground-based deployments are geographically constrained, politically precluded, or not pre-positioned. The leadtime available in the Desert Storm deployment cannot be guaranteed in future conflicts, thus eliminating the possibility of pre-positioning assets.

Whether from a full-up global constellation or from a limited launch on need constellation, multiple early-shot opportunities can be furnished by a space-based layer for missiles with ranges greater than approximately 500 kilometers. In addition, autonomous midcourse intercept of most TMD targets could be accomplished via ballistic extrapolation of booster burnout states to a predicted collision point.

National Missile Defense (NMD): As in TMD case, space-based interceptors can provide multiple early-shot opportunities, employing autonomous capability from detection to intercept. For example, during the boost phase flight regime, shot opportunities against a significant subset of CIS and Chinese threats are achievable, including: in-bastion CIS submarine launched ballistic missiles, and intercontinental CIS and Chinese missiles. Post-boost flight phase intercepts of multiple warheads boosters and midcourse flight phase intercepts of single reentry vehicles (RVs) can also be performed by a space-based layer.

Furthermore, external sensors can serve to increase the midcourse capabilities of space-based interceptors to include: penetration aided targets, debris accompanied targets, and bussed RVs.

In summary, a defense architecture that includes space-based interceptors will possess unique technical advantages, which increases effectiveness against various missile threats.

Question. What are your current plans for a single-site Limited Defense System (LDS) near Grand Forks, North Dakota? Have you made any cost projections for such a system? Under the current time-line, when would you begin construction work in North Dakota?

Answer. The current plans for a single site LDS are to deploy the system at the Stanley R. Mickelsen SAFEGUARD Complex near Grand Forks, ND. To the extent possible the existing facilities will be modified to support the LDS deployment. The system equipment and facilities planned for the site include the following: one ground based radar, silos for 100 interceptor missiles, command and control facilities, space-based sensor interface, mission support facilities, personnel support facilities, and infrastructure for the site.

Plus the military and civilian personnel required to operate and maintain the site.

The cost projection for a single site is $21.8B (then year dollars).

Under the current line-in, i.e., initial capability in FY04, construction will need to commence in FY01. Prior to the commencement of construction, the site utilization plan, an environmental impact analysis process, the design of the facilities, and necessary treaty-compliant dismantlement must be completed. This process will take approximately three years by planning for the activities to overlap. The results of the Bottom Up Review may affect these preliminary plans.

Question. Have recent program changes increased the technical risk of the Limited Defense System?

Answer. We have structured a program to pursue goals of the MDA which is to develop for deployment an operational and cost effective, ABM Treaty Compliant Ballistic Missile Defense with low to moderate risk. We would do this by maintaining careful control of the risk at all phases of the program. The results of the Bottom Up Review will determine which alternative program is pursued for the Limited Defense System.

THEATER DEFENSE PROGRAMS

Question. The FY94 budget request for TMD is about $1.8 billion, which is a significant increase from FY93, for a number of different technology programs in all the services.

How did you determine this final funding level?

It appears to me that you are developing at least six different TMD intercept technologies, with supporting sensors and command systems. Can you assure us that there is no overlap among these technologies? Is there any possibility of merging some of these systems to attain cost-savings?

What is the funding split between near-term and long-term systems? What would be the impact of this program if Congress directed the SDIO to focus its TMD efforts on the nearest-term technologies?

How does the Israeli Arrow and follow-on program relate to the U.S. programs? Is there any overlap of capabilities? Will the

Arrow, or other Israeli systems, be able to meet U.S. operational requirements?

Since these TMD systems appear to have significant benefits for our allies, has the Department considered soliciting foreign contributions to help support TMD research? This would go beyond foreign participation in research efforts, which are funded solely by the United States. For example, have you considered creating a Theater Defense Cooperation Fund, similar to the fund created to help support the Persian Gulf War? Are there any systems, such as the Corps SAM, in which allied governments might be especially interested?

Answer. a. The program growth is largely due to two factors: THAAD and TMD-GBR entering DEM/VAL phase at a cost of $718.38M ($484.27M THAAD, $234.11M TMD-GBR) and initiation of the major Navy TMD effort at $240M.

b. It is true that we are developing several TMD intercept programs to meet a wide range of needs in the near term and long term to defend the upper tier and the lower tier on the land and on the sea. All of the programs utilize a common technology base for materials, electronics, data processing, optics, etc. None of the programs will lead to a system with duplicative operational capabilities. The issue of possible overlap is better framed in the context of the widely varying threat that we face and the possible missions that we anticipate. Moreover, we must protect a variety of potential targets—fixed assets and infrastructure, maneuvering forces, population centers, ports, airfields, etc. It is not possible to provide a single weapon system that can be effective against the broad spectrum of current and emerging ballistic missile threats. An upper tier defense system will provide a broad area defense capability by engaging longer range threats at altitudes and distances not attainable by the more agile but smaller, lower-tier systems. The lower tier will be able to engage the "low altitude" and shorter range ballistic and air-breathing threats not engageable by the upper-tier systems. In a complementary sense, it is also very demanding to try to develop a single system that would be operationally effective, or even useful, in the wide range of missions which will be required for TMD. A sea-based capability would be highly mobile and able to protect coastal areas, including military amphibious operations, ports of debarkation, and most of the world's major population centers, from international waters. It also can provide defenses in support of the deployment of land based TMD systems and maneuver forces. In an effort to identify potential cost savings, we will evaluate a THAAD-variant missile as part of our concept definition phase for the Navy upper tier program. We also anticipate that Corps SAM, currently in concept definition, will leverage technologies from our other interceptor programs.

c. The funding split is roughly 75–80% of total funding on near-term projects. Congressional direction to focus on near term technologies would have minimal impact since we are focusing on the earliest possible capability at this time.

d. The ARROW and ACES programs relate to U.S. programs in that they contribute technology and test flight data. Developments such as the innovative Israeli amiable fragmenting warhead, multimode sensor concept, and infrared window technology can be used in future U.S. theater missile defense programs. Israeli flight tests against surrogate targets have provided data that will be of value to the THAAD program. Other cooperative and boost phase intercept concept study will contribute to the U.S. decision process about future technical and weapon system developments. There is no overlap of capabilities. The ARROW is an Israeli-developed missile that was designed to counter current and projected tactical ballistic missile threats facing Israel. The operational and technical requirements for the ARROW are dramatically different than requirements applicable to U.S. interceptors. U.S. anti-tactical ballistic missiles must be air transportable for rapid deployment worldwide and capable of countering the full spectrum of tactical ballistic missile threats present in all regions of the world.

e. Several allies have already contributed substantially to BMD program—noteworthy are the UK and Israel with whom cost sharing arrangements have routinely been established. We have not considered establishing a "cooperation fund" similar to the one you suggest. Although the suggestion probably has merit, cooperation between governments to the extent you suggest is a policy decision that extends well beyond the relatively narrow technical focus of the TMD effort. We are awaiting the outcome of the DoD Bottom Up Review for program guidance. Assuming DoD and congressional support that shows U.S. commitment, we anticipate continuation of our discussions with selected allies.

[Clerk's note.—End of questions submitted by Mr. Sabo. Questions submitted by Mr. Young and the answers thereto follow:]

STRATEGIC DEFENSE INITIATIVE

Question. General, the irony of the fall of the Iron Curtain and the dissolution of the Soviet Union, is that while our allies in Europe are a lot safer from any sort of a conventional attack, we still remain vulnerable to a nuclear strike. Your organization was formed in part to eventually get us to the point that we would be able to defend ourselves against such an attack, yet here we are after a lot of research and development still relying on our deterrent posture of the triad to protect us. Because of the START agreements, we are reducing our ICBM forces as are the Russians, but we are still and for some years to come, going to be dependent on our ability to strike to deter an aggressor. How many years will it be before we could do away entirely with our nuclear capability?

Answer. Maintaining a credible deterrent against attack, and particularly, nuclear attack against the United States or its allies, remains the cornerstone to U.S. national security policy. At the same time, we recognize that with the breakup of the Soviet Union, fundamental changes have taken place in the international security environment. In response to these changes, we have taken a number of steps to change the size and operational readiness of U.S. nuclear forces. We plan to make further large-scale reductions over the next decade as part of the implementation of the START and START II agreements.

In spite of these changes, we also believe that the future course of events in Russia—despite a promising trend—is uncertain. This uncertainty coupled with the fact that an increasing number of countries possess, or are seeking to acquire nuclear weapons and other technologies of weapons of mass destruction (WMD), combine to present risks to U.S. national security that we cannot ignore. Our nuclear forces, therefore, must remain an essential component of our national security strategy for the foreseeable future.

Question. The Department of Energy, which is charged with providing our nuclear weapons, is in the process of consolidating much of its plant structure. In that consolidation, it will be without the capability of producing neutron generators for as long as 8 years. The neutron generator is a critical component of our nuclear weapons systems. Does the Department of Energy talk to you about its plans to continue providing our current deterrent weapons? Have they specifically discussed this period in which they will be without the capability of producing neutron generators?

Answer. BMDO is invited to meetings of the Nuclear Weapons Council Standing Committee as an observer and is on the distribution for documentation relating to Council activities. This observer status is specifically for the purpose of allowing BMDO to observe and comment on nuclear weapons requirements and issues. DOE would be in a better position to answer this question.

Question. Intercepting tactical ballistic missiles over enemy territory during the boost phase has many advantages. In addition to doing away with the problem of collateral damage, missiles at that stage are relatively slow flying and easy to see. The Israelis have done some work, as have you, on this solution and last year, the U.S. agreed to do a joint study with Israel on Boost Phase Intercept technology. It is my understanding that Israel has proposed a joint U.S.-Israel program to design and test a Boost Phase Interceptor. What is the status of that proposal? Does it fit into the Administration's re-oriented SDI program?

Answer. Coordination activities on the joint U.S./Israel Boost Phase Intercept study are being finalized. When the study is finished a decision will be made whether or not to pursue a joint hardware demonstration program; no funding is available in the FY 94 budget for the demonstration program, however, study money in FY 93 is available. Boost Phase Intercept concepts are being strongly addressed in evolving Theater Missile Defense architectures.

[Clerk's note.—End of questions submitted by Mr. Young. Questions submitted by Mr. Skeen and the answers thereto follow:]

DIRECTED ENERGY WEAPONS

Question. The fiscal year 1994 budget contains funds for research on directed energy weapons (like lasers). Characterize for us the change in the annual funding levels for directed energy weapons during the past few years.

Answer. Prior to FY85, Directed Energy (DE) R&D was funded by DARPA and the Services. From FY85 to FY93, nearly all the Nation's DE R&D was funded within the SDIO budget. In FY94, two directed energy programs were transferred, with TOA, back to the Services (Army and Air Force). The Free Electron Laser (FEL) Program was transferred to the Army Space and Strategic Defense Command; the Air Borne Laser (ABL) Program was transferred to the Air Force Phillips Laboratory. The funding profile since 1985 is:

[In millions of then year dollars]

Fiscal year:	
1985	377
1986	796
1987	853
1988	934
1989	867
1990	701
1991	321
1992	263
1993	162
1994	100

Directed energy weapons (DEWs) are unique in their ability to provide continuously available, global early boost phase intercept of tactical and strategic ballistic missiles. This capability is highly effective for both theater missile defense (TMD) and national missile defense (NMD), and may be required to address future threats. Accomplishments to date have increased our confidence in out ability to build, within the next decade, DEWs effective against all ballistic missile threats, including projections for the evolving, proliferating threat. Major, one of a kind, components have been designed, built and tested. A large scale ground integration and test program is currently underway.

The decrease in Directed Energy funding has put completion of these programs in jeopardy. Continued decreases will further erode the corps of scientists and engineers—the industrial base—who fully understand the intricacies of high power DEWs, inflicting irreparable damage to the Nation's Directed Energy infrastructure.

Question. Which technologies are thought to be promising?

Answer. Chemical Laser, Neutral Particle Beam, Diode Pumped Solid State Laser, Free Electron Laser (transferred to the Army), and Acquisition, Tracking, and Pointing needed to support each of these.

The chemical laser (CL) program has been emphasized within DE due to its maturity and potential TMD/NMD utility. All the technologies required for the development and deployment of chemical lasers in space have been demonstrated at levels large enough to be easily scaled to weapon level power. A fully integrated ground experiment of these components is well underway and is scheduled to be complete in 1996. Properly deployed, a constellation of space based chemical lasers could provide continuous global early boost phase intercept of tactical and strategic ballistic missiles. This capability is highly effective for both theater missile defense (TMD) and national missile defense (NMD), and may be required to address future threats. Early boost phase interception of ballistic missiles is extremely important in ballistic missile defense because it destroys the missile before it can release multiple warheads, decoys, or chemical/biological munitions, or before the warhead is obscured by debris. It also ensures that debris falls far from defended territory, often on the territory of the aggressor. This same system could also negate high flying aircraft (bombers and cruise missiles), perform midcourse interactive discrimination (MCID) of ballistic missile warheads from decoys, and provide exquisite visible and IR imagery.

The neutral particle beam (NPB) program is being pursued as an alternative for MCID, for a unique satellite "inspection" mission (for space mines), and for electronics kills of RVs and busses. The NPB will continue development and integration of its key technologies over the next few years, followed by an integrated system demonstration.

The diode pumped solid state laser (DPSSL) program is exploiting recent advances in laser technology that have potential payoff in ballistic missile defense. The objective of the program is to investigate the potential of a DPSSL to produce outputs of sufficient power and beam quality, and operate for sufficiently long periods of time, for use in ballistic missile defense.

The acquisition, tracking, and pointing (ATP) program will continue efforts to advance the technologies required to perform critical ATP functions for all candidate DEW concepts.

Question. Which technologies have failed, and are no longer being pursued?

Answer. The fact that certain technologies are no longer being pursued does not mean that they have "failed". We simply recognize that when the budget process provides insufficient funding to carry cost efficient and timely programs in all of the promising technologies, downselect decisions must be made. Although the discontinued programs had demonstrated some successes, the outstanding utility (in BMD architecture) of systems based on technologies we continue to pursue made them the obvious choices for continued funding. Technologies no longer being pursued include the excimer laser, the charged particle beam and nuclear driven directed energy concepts. The free electron laser has been transferred to the Army.

Question. Explain the major directed energy programs for which funds are requested in the fiscal year 1994 budget. For the record, provide the 1994 funding, total program funding, key milestones, and contractors involved in each of your current directed energy programs.

Answer. The Chemical Laser Program funds the continuing development of high energy laser (HEL) technologies for a broad range of applications. These technologies include HEL beam generators, HEL beam control, and advanced HEL high power optics. Integration of these technologies in ground-based experiments is also well underway. One application of this technology, the space based laser (SBL), provides a powerful hedge against potential future threat.

The current emphasis in the Chemical Laser program is an integrated ground demonstration of weapon scalable SBL components (the Alpha/LAMP Integration (ALI) experiment).

The objective of the Neutral Particle Beam (NPB) program is to demonstrate the feasibility of using a stream of neutral atomic particles to penetrate into a space target 1) to provide electronic kills, 2) induce signatures that permit discrimination, and/or 3) to "inspect" other satellites. Such a beam would be capable of effecting electronics kills of ballistic missile busses or RVs in their post-boost and midcourse phases, sorting warheads from decoys by measurements of target mass, or inspecting satellites for nuclear materials. The NPB project addresses the key technical and system issues associated with the feasibility of developing an NPB system capable of all these missions. The project continues to develop enabling technologies for ground and space experiments and initially deployable NPB systems. The Accelerator Test Stand (ATS) was used to integrate and test low energy components; the Ground Test Accelerator (GTA) is the primary test bed for initial NPB system development and also for advanced technologies such as high brightness ion sources, advanced neutralizer development, and telescopes able to focus and rapidly retarget the beam. The Continuous Wave Deuterium Demonstrator (CWDD) examines high duty factor and deuterium operation at low energies.

The Acquisition, Tracking, and Pointing (ATP) program will continue efforts to advance the technologies required to perform critical ATP functions for all candidate DEW concepts. Three major thrusts include the advanced DEW Active Precision Tracker Program (ADAPT), High Altitude Balloon Platform Experiments (HABE), and technology base development. ADAPT is currently establishing ATP requirements and developing design concepts to meet future DEW mission requirements. The high altitude balloon program will carry out integrated ATP experiments.

The pace of ATP development is planned to support a technology demonstration of a directed energy weapon concept in the late 1990's, which could lead to an initial operational capability early in the next decade.

The Diode Pumped Solid State Laser program is exploiting recent advances in laser technology that have potential payoffs in ballistic missile defense. In the past, solid state lasers have been pumped by flashlamps which were uneconomical in their ability to convert electrical energy into light at the wavelength required for pumping the solid state laser. Recent technical advances have produced highly efficient diode lasers that can produce light at the frequency required for pumping solid state lasers. In addition, stimulated Brillouin scattering may enable high quality wavefront control.

Lawrence Livermore National Laboratory has been chosen to lead this program because of its extensive experience in solid state lasers. The objective of the program is to investigate the potential of a diode pumped solid state laser to produce outputs of sufficient power and beam quality, and operate for sufficiently long periods of time, for use in ballistic missile defense.

BMDO funding for the Air Force Airborne Laser (ABL) program supports experiments to determine the range to which the laser can propagate, and therefore, its operational capability.

BMDO funding for the Navy Point Defense demonstration supports part of a joint BMDO/US Navy/Royal Navy demonstration of chemical laser lethality against radially inbound missiles using the existing MIRACL laser/Sealite beam director test bed at the White Sands Missile Range. The BMDO program will not only gain important information on laser operations in operational scenarios, but also new insights on laser lethality in realistic conditions.

The specific programs, their funding levels, and contractors are:

Program: 1302 Chemical Laser.

BMDO Funding to Date (TY $M): 876.

1994 Funding, $M: 59.1.

Contractors: Martin Marietta, Lockheed, TRW, Itek, Hughes.

Program: 1303 NPB.

BMDO Funding to Date (TY $M): 789.

1994 Funding, $M: 25.6.

Contractors: Grumman, Los Alamos National Laboratory.

Program: 1305 ATP.

BMDO Funding to Date (TY $M): 1586.

1994 Funding, $M: 10.6.

Contractors: Martin Marietta, Lockheed, Draper.

Program: 1307 Diode Pumped Solid State Laser.

BMDO Funding to Date (TY $M): 4.

1994 Funding, $M: 3.9.

Contractors: Lockheed, Lawrence Livermore National Laboratory.

Program: 1307 ABL.

BMDO Funding to Date (TY $M): 12.

1994 Funding, $M: 0.9.

Contractors: Lincoln Labs, RDA, WJSA.

Program: 1307 Navy Point Defense.

BMDO Funding to Date (TY $M): 0.3.

1994 Funding, $M: 0.05.

Contractors: TRW.

Total, 1994 Funding, $M: 100.1.

The major milestones that will be supported by these funds are:

CL:	
4-meter monolithic facesheet	4Q93
Complete Alpha/LAMP Integration facility and begin integration	1Q95
Alpha/LAMP Integration high power demo	1Q96
NPB:	
Continuous Wave Deuterium Demo (CWDD) Radio Freq Quadrupole (FRQ) operational	4Q93
Ground Test Accelerator Operational	4Q94
ATP:	
High altitude balloon experiments (HABE) passive sensor flights	2Q94
HABE active sensor flights	2Q95
DPSSL: 1 KW Demo	1Q95
ABL: Atmospheric Transmission Studies	(1)
Navy Point Defense:	
Demonstration against static missiles	1Q94
Demonstration against flying missiles	4Q94

[1] Continuing.

Question. For each of these, what is the earliest date that these devices could be deployed operationally?

Answer. With adequate funding levels, each of the systems could be operational in the first decade of the next century. Assuming a robust development program, initial capability for each of the systems could be reached as follows:

Chemical Lasers (SBL): 2002–2005.

Space Based Neutral Particle Beams (SBNPB): 2005–2008.

ABL: Transferred to AF.

DPSSL: TBD (scalability must first be demonstrated).

Question. Explain the proposed new start for the MIRACL laser/SEALITE beam director in antiship-missile defense tests. How much is included in the fiscal year 1994 budget, and what is the total cost for these tests? What are the growth implications for this device in ASAT applications?

Answer. This technology program is a joint BMDO/US Navy/Royal Navy test series. These point defense tests are to demonstrate the lethality of directed energy weapons against radially inbound missiles. One important result of these tests will be the determination of the effects of thermal blooming in point defense scenarios.

The program was planned as a two year program (FY93–94) at a total cost of $6M, to be shared equally by the three sponsors. BMDO provided $0.3M in FY93. However, due to the large reductions in BMDO/DE budgets, BMDO has been able to budget only $0.05M of the remaining $1.7M for FY94.

There are no implications for ASAT in the planned experiments. No changes to the current system are planned, and the tests will be performed at extremely low angles of elevation and short ranges.

[Clerk's note.—End of questions submitted by Mr. Skeen. Questions for the record and the answers thereto follow:]

GOALS FOR SDI PROGRAMS

Question. Describe the key dates and events for GPALS.

Answer. Program objectives, direction, content and funding levels are currently the subject of the strategic review being led by the Secretary of Defense. The outcome of this review may significantly alter the key dates and events listed below for the last administration's "GPALS" program. Major events and milestones for our Ballistic Missile Defense programs are:

LIMITED DEFENSE SYSTEM

Ground Based Radar and Interceptor Dem/Val Testing	1QFY97
Begin Brilliant Eyes On-Orbit Operations	2QFY98
BM/C3 Validation Experiment	4QFY98
Development System Integration Testing	4QFY01–2QFY02
Begin Production	4QFY02
Initial Deployment Option	FY04

THEATER MISSILE DEFENSE

Below is the schedule of TMDI key events. These dates may change as a result of the Secretary's Bottom-Up Review. Final operational capability dates have not been included because they have not been established.

Patriot PAC–2: First Unit Equipped (FUE)[1]	4Q93
Patriot PAC–3: MS IV Review	3Q98
Patriot PAC–3: Missile FUE	3Q98
Corps SAM:	
MS I	4Q93
Early Developmental Testing	2Q95–1Q98
Early User T&E/OEA	3Q97–2Q98
Follow-on DT&E/OA	2Q00–2Q01
LRIP Review	1Q01
IOT&E	1Q02
MS III	4Q02
IOC	2005
THAAD:	
Initial Design Review	2Q93
Final Design Review	4Q93

Missile Flight Tests (10)	4Q94–4Q95
System Flight Tests (10)	4Q95–4Q96
MS II Review	4Q96
LRIP	2Q99
IOC	4Q01
MS III Review	1Q02
TMD–GBR:	
Testbed Critical Design Review (CDR)	3Q93
System CDR	2Q94
Testing w/THAAD	4Q94–4Q96
MS II Review	4Q96
LRIP Review	2Q99
IOC	4Q01
MS III Review	1Q02
USMC Hawk/TPS–59:	
Developmental Testing	4Q95
Operational Testing	1Q96
IOT&E	1Q97
AEGIS/SM–2 Block IV A:	
MS IV Review	3Q94
UOES	4Q97
FUE	2Q99
SEA-BASED TBMD:	
MS I Review	3Q95
UOES	2Q00
FUE	2Q02
ACES:[2]	
Arrow I Flight Tests (4)	2Q93–4Q93
IIT Flight	1Q94
Arrow II Flight Tests (6)	3Q94–3Q95
Israeli FSD Decision	1Q95
ACES Final Report	3Q95

[1] Initial operating capability (IOC) for systems already fielded.

[2] Note: This is not a system the U.S. will field.

TOTAL COST OF SDI PROGRAMS

Question. Last year DOD testified that the acquisition cost of GPALS in constant 1991 dollars is $46 billion.

What is the current acquisition cost estimate of GPALS in both constant and real (then-year) taxpayer dollars?

Answer. The current acquisition costs (from FY 1992 to FY 2011) for Ballistic Missile Defense Organization programs are as follows (all dollars in billions):

	FY 1988 dollars	TY dollars
Theater Missile Defense	$13.5	$19.0
National Missile Defense	15.2	21.8

Acquisition costs include those costs funded either through the RDT&E, procurement, or military construction appropriations to provide a new or improved capability. Acquisition costs for BMDO elements primarily comprise the Demonstration and Validation (Dem/Val), Engineering and Manufacturing Development (EMD), and Production phases. Funding for development of technology not specific to an element are not included in BMDO acquisition costs, as well as programs such as the Navy TMD initiative that are not yet in a formal acquisition program. The Secretary is reviewing the BMD program and his decision on the program will likely affect the acquisition cost projections above.

Question. What are the acquisition costs for each of the components of GPALS (Limited Defense System, Theater Defense, etc.) of GPALS in both constant and real taxpayer dollars?

Answer. The current acquisition cost estimate of components currently under DAB purview in billions of FY88 dollars and then-year (TY) dollars are as follows:

	FY88	TY
Strategic:		
Command and Control Element (C2E)	1.203	1.630
Ground Common	.244	.361
Systems Engineering and Integration (SE&I)	2.748	4.028
System Test and Evaluation (ST&E)	2.251	3.295
Brilliant Eyes (BE)	2.932	4.264
Ground Based Radar (NMD) (NMD GBR)	1.537	2.131
Ground Based Interceptor (GBI)	4.242	6.104
Subotal	15.157	21.813
Theater:		
C2E	.161	.223
SE&I	.061	.081
ST&E	.147	.215
BE	.959	1.351
Upper Tier Theater Missile Defense (UTTMD)	6.388	8.858
Theater High Altitude Air Defense (THAAD)	(4.153)	(5.741)
Ground Based Radar (TMD) (TMD GBR)	(2.235)	(3.117)
Corps Surface to Air Missile (Corps SAM)	3.429	5.089
Phased Array Track Radar Intercept of Target (PATRIOT)	2.385	3.161
Subtotal	[1] 13.531	18.978
Total	28.688	40.791

[1] Figures may not add due to rounding.

Acquisition costs include those costs funded either through the RDT&E, procurement, or military construction appropriations to provide a new or improved capability. Acquisition costs for BMDO elements primarily comprise the Demonstration and Validation (Dem/Val), Engineering and Manufacturing Development (EMD), and Production phases. Funding for development of technology not specific to an element are not included in BMDO acquisition costs, as well as programs such as the Navy TMD initiative that are not yet in a formal acquisition program.

Question. Under your current plan, how much funding will SDI require in each of the next five years in real taxpayer dollars?

Answer. The Secretary of Defense is conducting a Bottom-Up Review, currently in progress, to determine the ballistic missile defense program and total funding requirements for that program over the next five years. Those funding levels will not be available until after the Bottom-Up Review has been completed.

Question. What options under consideration in the "bottom-up review" could affect SDI programs?

Answer. The purpose of the bottom-up review is to assist the Administration in the selection of a course of action, and every option under consideration would affect at least some SDI programs.

LIMITED DEFENSE SYSTEM

Question. The Limited Defense System is envisioned to protect the continental United States from ballistic missile attack. Without modifications to the ABM Treaty, the initial deployment must be at Grand Forks, North Dakota, and involve no more than 100 ground based interceptors. The fiscal year 1994 budget requests about $1.2 billion for LDS, with initial operating capability now planned for the year 2004. What capability would the nation get by deploying a single ABM treaty compliant site?

Answer. With GBR, GBI and C2E at Grand Forks and a BE constellation overhead, very high levels of protection can be given to all of the continental United States for limited attacks from the north. BE's early detection capability provides maximum battlespace for multiple GBI shots and battle planning in nuclear environments. The GBR provides very good discrimination and tracking data in both natural and nuclear degraded environments. Both sensors complement each other to nullify countermeasures. Protection from attacks from the south or from submarines off the coasts and protection of Alaska and Hawaii can only be achieved through additional sites.

Question. What parts of the country would not be covered?

Answer. Against small attacks from the north, all of the Continental United States (CONUS) would be covered. The Ground Based Interceptor (GBI) can not reach Alaska and Hawaii in time to cover them. For attacks from the south and close-in attacks from the sea, areas along the southern border and coasts would be unprotected.

Question. Does the new Administration plan to provide "cueing" to the Grand Forks site from other existing radar sensors (like BMEWS, Pave Paws, OTH–B, etc.), and can this be done without ABM Treaty modification?

Answer. The U.S. has begun a comprehensive examination of U.S. ballistic missile defense policy and objectives and related ABM Treaty issues. This review, which should be completed in the near future, will provide the basis for the U.S. decisions for ballistic missile defenses, including the need for the ABM treaty modification, if any. However, support of the radar at the Grand Forks site by early warning radars is consistent with current Treaty interpretation.

Question. Does the new Administration plan to deploy further sites in addition to the initial site at Grand Forks?

Answer. As reflected in the deployment plans currently reported to Congress in July 1992, BMDO is focused on a single site. Threats from the south or from the sea near the CONUS coasts cannot be effectively engaged with interceptors from the Grand Forks, ND location. If these threats materialize additional sites would be necessary in order to protect all of CONUS. A single site cannot defend Alaska or Hawaii. Another reason the U.S. might want to move to additional sites would be that additional sites provide the opportunity for more effective, multiple shot "defense in depth" that is important in order to achieve "near perfect" performance levels.

Question. How does the current estimate for Grand Forks IOC (initial operating capability) compare to the former Administration's plan last year, and to subsequent requirements in the 1993 Defense Authorization Act?

Answer. The former Administration's 1992 SDIO (now BMDO) Report to Congress proposed options to begin deployment as early as FY97 using tested Demonstration/Validation hardware which was referred to as a User Operational Evaluation System (UOES). The UOES would later be replaced with operational hardware following completion of Engineering and Manufacturing Development (EMD) and Initial Operational Test and Evaluation (IOT&E). The 1993 Defense Authorization Act reduced the former Administration's BMDO budget, deferred an initial site deployment until "no sooner than" FY02 and directed that the program should be of low to medium risk. In response to that Congressional guidance, the former Administration's 1993 Report To Congress dropped the UOES option and proposed a FY04 date to begin deployment of operational hardware. USSPACECOM will determine when an Initial Operational Capability (IOC) is available, however, the current estimate of a date to begin deployment of an initial site remains at FY04.

Question. What is the cost in real taxpayer dollars to deploy a single ABM Treaty compliant site at Grand Forks?

Answer. In then-year dollars, the total acquisition cost to develop and deploy a single ABM treaty compliant site at Grand Forks is $21.8 Billion. This cost represents BMDO's initial adaptation of a multi-site architecture to a single site architecture. We are in a continuous process with our Service executing agents of preparing the formal technical and cost documentation (CARDS) for this reduced architecture.

As part of this process, alternatives have been proposed and are under consideration by BMDO. When alternative cost estimates are compared to the President's Budget request, there is potential for some cost savings beyond the FYDP. These cost savings occur primarily after FY99 and result from compressed deployment schedules, reduced testing and less engineering. We will carefully consider single site alternatives in light of Congressional guidance for a low-to-moderate risk program. Should alternative funding strategies be judged as reflecting an acceptable level of risk and compatible with projections of the total BMDO budgets, then we would develop a new acquisition strategy, eagerly embrace a change in deployment, and release the projected savings. Finalization of any alternative will require the output of the Bottom-Up Review.

The baseline cost to deploy a single ABM treaty compliant site at Grand Forks contained in the President's Budget Request resulted from extensive coordination, review and analysis within the Department and continues to represent the Secretary's guidance. In our partnership with the Services, we will continue to synergistically refine the NMD program to identify and incorporate all savings that can be derived without increasing acceptable risk or degrading system performance.

Question. How would the fiscal year 1994 funds for LDS be used?

Answer. The $1.2B LDS P.E. for FY94 is divided into four program areas: Systems Development ($699M); Risk Mitigation ($76M); Threat Evaluation ($292M) and Critical Support ($128M). These program areas are integrated to provide a low to medium risk program that would begin deployment of an operational site with operational hardware in FY04.

The $699M Systems Development program area consists of contracts and government evaluation teams for BMC3 and System Engineering and Integration, GBI, GBR, BE (jointly funded with the TMD P.E.) and System Test. The BMC3 has the responsibility of linking GBR and BE to GBI as well as passing threat data to TMD. A small communications contract for the ground entry points at Kwajalein Missile Range and the National Test Facility will be awarded in late FY93 with the delivery of off-the-shelf hardware starting in FY94. Several small DEM/VAL Options Assessment contracts starting in FY93 will continue in FY94 to demonstrate the industry present capabilities for BMC3 as well as in the System Engineering and Integration approaches for Ballistic Missile Defense.

The System Development plan is to award the GBI contract in early FY94 and to move quickly through preliminary design into building hardware for kill vehicle flight tests. The continuing Raytheon GBR contract will have made decisions on the subcontractor vendors and work will begin on building the many individual pieces of the phased array test radar for the Kwajalein Test Range. The BE FY94 funds will be used primarily to fund the two prime contractors—Rockwell and TRW—to complete their detailed designs of the Dem/Val satellites, perform ground demonstrations, and purchase flight hardware for the Dem/Val satellites. Additionally, the money will fund required technology developments and demonstrations (cryocoolers and sensors), test support (sensor test facilities at Arnold Engineering and Development Center), and program office operations. The System Test will start the development and validation of the tools that will be used by the Operational Test and Evaluation community to judge program success or failure.

The $76M Risk Mitigation program area is developing sensors, processors, cryocooler, space rated materials, space communications and interceptor components in support of the GBI and BE contractors. The results of these small programs will be integrated into the element contracts as problems arise.

The $292M Threat Evaluation program area has contracts to obtain threat signatures and basic physics data on earth and space backgrounds from sea and airborne platforms: the Midcourse Space Experiment (MSX) to collect space data and to evaluate concepts that support BE, survivability experiments to ensure that the mission will not be negated by nuclear environments, lethality tests to provide high kill confidence and the targets for all LDS P.E. testing.

The $128M Critical Support program area has the National Test Bed at Falcon AFB and Army Advanced Research Center at Huntsville where system simulation takes place and where the User develops his Concepts of Operations. This program area also includes hardware-in-the-loop test facilities, the data centers to maintain and evaluate BMDO test data and the national test range support for interceptor and sensor testing. Finally, this program area supports the early efforts of the OSD Operational Test and Evaluation community to develop the tools needed to verify that BMDO is meeting its milestones.

Question. Is the new Administration considering cancelling LDS altogether?

Answer. The new Administration sent an BMDO FY94 budget to Congress that included $1.2B in the LDS P.E. Secretary Aspin is completing a strategic review ("bottom-up" review) of a range of BMDO options for both the Theater and the U.S.

SINGLE SITE AT GRAND FORKS

Question. Last year DOD testified: "If relief from the Treaty could be obtained in time, deployment of the initial site in the Northeast followed by a Northwestern site would eliminate the need for a site at Grand Forks—and $1–2 billion could be saved." Is this also the view of the new Administration?

Answer. Although Grand Forks is the only missile defense site allowed by treaty, it is an optimal site only for a single site system. It is not an optimal location should a multi-site system be envisioned in the future. The "view of the New Administration" is not yet determined. Secretary Aspin has initiated the "bottom-up" review to consider BMDO options.

Question. Why do any work at Grand Forks if it is not the best place militarily to perform the mission?

Answer. Congress authorized appropriations in the Missile Defense Act of 1991 to carry out site preservation work at Grand Forks and it also authorized appropriations to carry out a site-specific environmental impact statement, expressly waiving the requirement to evaluate alternative sites to the site at Grand Forks. The Amended 1991 Missile Defense act continued the direction to develop for deployment a treaty-compliant ABM system at a single site. Grand Forks provides protection for all of the continental United States against attacks from Asia, Europe and Northern Africa based upon using the GBR, 100 GBIs, a Command and Control Element and a small constellation of BE satellites. It is not the best location if a multiple site system defense system were considered in the future. Such a system is not, however, treaty compliant.

Question. What percentage of this nation's metropolitan areas receive no protection from a single ABM treaty compliant ABM site and Grand Forks?

Answer. Final determination of the Treaty compliance of the specialized element, planned for deployment at the initial site has not been completed. All of the continental United States can be protected against limited attacks from Asia, Europe and Northern Africa using GBR, 100 GBIs and a Command and Control Element at Grant Forks and a small constellation of BE satellites. None of Alaska and Hawaii can be protected from Grand Forks. Attacks from the South or from the sea near U.S. coasts will leave portions of the nearest coast unprotected. The exact percentage of the metropolitan areas depends upon the particular attack direction and particular launch distance from the coast.

Question. Please explain what has to be done technically at Grand Forks to make it a viable site.

Answer. First, as provided in the Missile Defense Act of 1991, site deterioration must be stabilized. The major effort to stabilize the site was accomplished in Fiscal Year 1992. A modest effort to maintain and repair critical facilities is necessary to ensure public safety and health of the communities surrounding the site.

Second, environmental analysis and planning is required. Based on the uncertainty of deployment, we deferred the completion of a site specific Environmental Impact Statement (EIS). In Fiscal Year 1992, an extensive environmental baseline was established. The basic outline for the site specific EIS has been prepared. In Fiscal Year 1994, continued monitoring of groundwater seepage in and around the site is required to assure that no potential hazardous materials or wastes migrate into the sources for public water systems. Also, continued discussions on the Cold War significance of the site must be conducted, and conclusions reported to the State Historical Preservation Office. Prior to activating the site, a site-specific EIS will be required.

Third, a site utilization plan is required to be developed. The ground based system necessary to defend the homeland requires the placement of a radar system, and ground based interceptors. The relationship between the system components needs to be identified, and real estate restrictions based on health and safety considerations established.

Fourth, the site utilities, and commercial utilities to support the operation of the site must be identified. Some utility upgrades are expected, and represent the long-lead in any Military Construction program.

Fifth, facility design and construction will be required. Some facilities are planned for reuse, other facilities will be required to be constructed.

Question. How much is budgeted in fiscal year 1994 for work solely related to Grand Forks development or deployment?

Answer. Approximately $700,000 in project 3113 is set aside in the Fiscal Year 1994 budget solely for work at the Grand Forks site. First, site stabilization (maintenance and repair) must continue to ensure that key facilities do not deteriorate and become unsafe structures. These funds provide for a caretaker to be resident on site to accomplish these essential repairs to ensure public safety and health. Also, funds are necessary to develop a Hazardous Materials Spill Response Plan required by the State Environmental Office, and begin to prepare a site utilization plan for the long term use of the site. The remainder of project 3113 funds budgeted in Fiscal Year 1994 will be used to accomplish the overall Ballistic Missile Defense Programmatic Environmental Impact Statement (EIS).

Question. If the ABM Treaty were modified to allow it, how soon would Brilliant Eyes become involved to support operations at Grand Forks, and what additional capability would this provide?

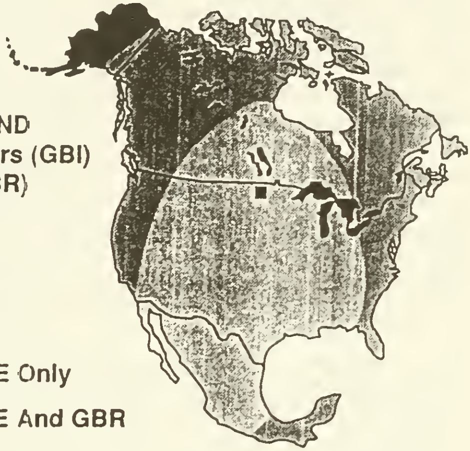
Answer. The National Missile Defense (NMD) elements (Ground Based Interceptor, Ground Based Radar, Brilliant Eyes and Command and Control Element) acquisition strategies are designed such that Brilliant Eyes (BE) is initially operational to support the first NMD site at Grand Forks should it become operational in FY04. The attached figure shows the defense capability against northerly threats from a single site of Ground Based Interceptors (GBI) and Ground Based Radar (GBR) with and without Brilliant Eyes.

If the GBI must rely on GBR for commit data on the ballistic missiles before the GBI launch, a substantial portion of the continental US is unprotected from potential ballistic missile threats from China, CIS or the Middle East. Because GBR coverage is limited by the earth's curvature and radar power, the ballistic missile threat coverage is well along its trajectory before GBR detects it, and thus GBI can not launch until fairly late in the ballistic missile trajectory, leaving much of the US completely vulnerable. With the addition of Brilliant Eyes to provide very early commit data and later update data, GBI can launch before these long-range missiles are within GBR detection range, allowing GBI maximum time of flight and greatly increasing the defended area achieving full coverage of the continental US from a single site against this northerly threat.

The Treaty compliance of BE has not been determined and therefore the necessity and scope of required modifications to the Treaty, if any, remain to be defined.

BALLISTIC
MISSILE
DEFENSE
ORGANIZATION

HOMELAND DEFENSE CAPABILITY AGAINST NORTHERLY THREATS



- Single Site At Grand Forks, ND
    - Ground Based Interceptors (GBI)
    - Ground Based Radar (GBR)
    - Brilliant Eyes (BE)

■ No Coverage

▨ Intercept Supported By BE Only

□ Intercept Supported By BE And GBR

Question. Explain why the single site at Grand Forks was decommissioned originally, and what is different now.

Answer. There were two basic, interrelated reasons for closing down the Safeguard site in early 1976. First, there were inherent weaknesses in the Safeguard system, which started out as Sentinel under the Johnson administration. Sentinel was to provide limited population protection against light, unsophisticated missile attacks from an "Nth country" such as China. As a result it was to use both high altitude and low altitude interceptors (Spartan and Sprint respectively), both of which were equipped with nuclear missiles. The Nixon administration transformed Sentinel into Safeguard, which was intended primarily to protect American missile fields. At this time, protecting missile fields could have been accomplished more effectively by using only low altitude interceptors, since this would have allowed the defense to take maximum advantage of atmospheric discrimination in which air friction strips decoys and booster debris away, making it easy to spot actual warheads. However, the Nixon administration kept the same Spartan/Sprint missile mix that was part of Sentinel.

Another of Safeguard's inherent weaknesses was the vulnerability of its radars to an attack by Soviet ICBMs; such an attack would blind the Safeguard system and prevent it from being used against later waves of warheads that would then attack the American ICBMs defended by Safeguard. Furthermore, assuming the Soviets did not attack the radars, Safeguard would blind itself when the nuclear warheads on its own missiles detonated. Moreover, the detonation of Safeguard's warheads could pose a danger to inhabitants of the U.S. and Canada.

A second cause for closing Safeguard was that it was severely limited by the ABM Treaty of 1972. The original Safeguard plan envisioned a phased deployment of missile defenses at as many as twelve sites. Under terms of the treaty and a 1974 protocol, the U.S. and Soviet Union were restricted to one ABM site with 100 interceptors. The technical limitations of Safeguard, combined with the limited numbers of interceptors allowed under the treaty, meant that Safeguard could not effectively defend a strategically significant portion of America's deterrent forces against a massive Soviet strike.

What has changed since 1976 when Safeguard was closed is that there has been a revolution in missile defense technology. The Army recognized the technical limitations of the Safeguard system. As a result, the Army's post–1976 research and development program concentrated on developing technologies that would make a hit-to-kill interceptor feasible. The development of such an interceptor would eliminate the need for nuclear-tipped interceptors and the problems associated with them (e.g., the self-blinding problem of Safeguard).

Moreover, the Army's work led to improvements in sensors and a substantial increase in the computing power that could be packed into small computers that could be carried aboard interceptors. These advances combined to provide a quantum leap in on-board guidance capabilities. Improvements in guidance translated into extended ranges for interceptors, since interceptors need no longer depend on ground-based radar for guidance through their flight.

Now, once an interceptor is cued to a point where its own sensors and guidance system can take control, the interceptor guides itself into an incoming warhead.

Elements of this technology were demonstrated in the Army's Homing Overlay Experiment of June 1984. Over the next eight years, hit-to-kill technology was further refined by the Strategic Defense Initiative organization (now Ballistic Missile Defense Organization). The full maturity of this technology was demonstrated in SDIO's exoatmospheric re-entry vehicle interceptor subsystem (ERIS) tests in January 1991 and March 1992. Today, hit-to-kill is a proven technology that is being applied in the Ground-Based Interceptor that will be the first generation missile in the National Missile Defense system.

BRILLIANT EYES

Question. Brilliant Eyes is envisioned as a key component of GPALS to provide highly distributed space-based surveillance and tracking. The fiscal year 1994 budget requests $253 million to continue its development. General O'Neill, please describe Brilliant eyes technically and how it works.

Answer. The Brilliant Eyes (BE) element is a distributed space based surveillance satellite system that is designed to support both national and theater ballistic missile defense needs. A constellation of BE satellites provides global (below-the-horizon and above-the-horizon) access of ballistic missiles in their boost, post-boost, and midcourse phases in response to directed tasking from the command and control element. BE provides surveillance and track data to support overall command and control, active defense, passive defense and attack operations.

BE satellites carry a suite of passive sensors including short-, medium-, and long-wavelength infrared and visible light sensors. These sensors acquire and track strategic and longer range tactical ballistic missiles in the boost phase and continue to track and discriminate the reentry vehicles from debris and penetration aids throughout the midcourse flight of the missiles. The satellites are in low earth orbits which afford relatively short ranges to the missiles compared to early warning geosynchronous satellites allowing missile and warhead tracking after their engines stop burning necessary to provide accurate track data for interceptor support.

In normal operations for National Missile Defense, Brilliant Eyes requires warning of an unexpected ballistic missile launch in order to cue its below-the-horizon sensors to acquire and begin tracking the missiles. This boost phase cue can come from existing National assets such as the Defense Support Program (DSP) or future National assets such as the Follow-on Early Warning System (FEWS). However, in cases in which increased tensions, intelligence information or theater conflicts exist, Brilliant Eyes is able to maintain continuous monitoring of small regions obviating the need for an external boost phase cue from another system. In either case, BE's below-the-horizon scanning sensors acquire the burning missiles from an external cue or small region surveillance. The constellation of satellites provides at least two satellite access of any missile launch to guarantee acquisition and allow accurate tracking. The scanning sensor is complemented by a narrow field-of-view staring sensor that picks up the booster at burnout, when the signature decreases many orders of magnitude to that of a post-boost vehicle, an aerothermally heated body or to a cold body that had been protected against ascent heating and continues tracking throughout the midcourse phase. Two dimensional track data from two satellites is exchanged via space communication cross links for processing into three dimensional state vector track files. These data along with target feature data are transmitted to the ground and converted by ground-based computers in the BE element operations center and the command and control element into accurate missile launch point data to facilitate quick retaliation before mobile launchers can flee, accurate warhead impact point information to improve warnings, and target updates for use in assigning, launching, and providing in-flight target updates to interceptors.

BE's ability to track ballistic missiles far beyond the ground based radar horizon and produce track files accurate enough to launch and guide interceptors substantially increases the defended area by the interceptors (national and theater). BE cues radars (ground based or ship based) to acquire the reentry vehicles increasing their detection range (up to double) by focusing their energy. Energy management of the radars also greatly decreases their vulnerability to anti-radiation weapons.

Question. How many satellites are involved?

Answer. The operational constellation requires 12 to 40 satellites to support National Missile Defense and Theater Missile Defense. The exact number depends on offensive threat developments, required performance, and the number of sites for defense of the United States.

Question. How much capability improvement do you estimate Brilliant Eyes provides, compared to only ground-based radar systems?

Answer. The improvements in capability which Brilliant Eyes provides is driven by the nature of threat assumptions and by the siting of the ground-based assets, radars and interceptors. For example, with a single site of ground-based interceptors at Grand Forks, North Dakota, without Brilliant Eyes early tracking, discrimination, and interceptor support, much of the continental U.S. is vulnerable to potential threats from the Commonwealth of Independent States, China or the Middle East. On the other hand, a combined system of ground-based interceptors and radars with Brilliant Eyes support can provide complete coverage of the continental U.S. from the single site against this northerly threat (see attachment 1).

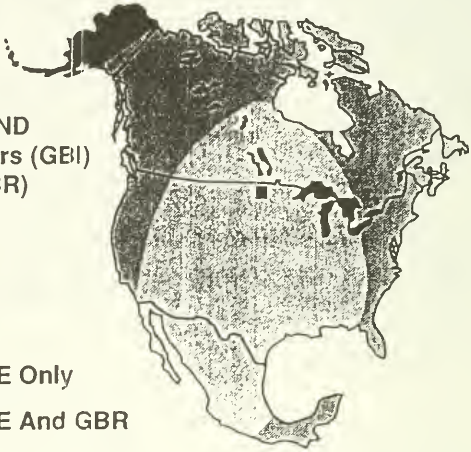
Attachment 2 shows the increased defended areas due to Brilliant Eyes data in supporting the Navy Vertical Launch System (VLS) against two different range theater ballistic missiles. In the first case the threatened area shown is from a 1,000 km range ballistic missile. The smallest defended area inside the threatened area represents the defended area from a Navy VLS using only Aegis radar support for interceptor commit. The next larger area is the defended area from the Navy VLS using Brilliant Eyes data to cue the radar which increases its range and then radar data being used to commit the interceptor. Finally, the largest defended area is that in which Brilliant Eyes data is used to commit the interceptors before the radars can detect the missiles. As seen, the increase in defended area is tremendous when the accurate, early Brilliant Eyes data is utilized by the interceptors for commit. By extrapolating this increase in defended area to protection of a given region, the number of interceptors and sitings necessary are greatly decreased resulting in an overall cost savings to provide a given level of protection. The second picture represents the same three levels of sensor support to the interceptors but against a longer range ballistic missile, in this case 3,000 km. The effects of Brilliant Eyes support are far more dramatic against longer range threats because of the longer flight times of ballistic missiles. This allows the interceptors to fly longer and greatly increases their defended areas.

Attachment 3 illustrates the impact of interceptor burnout velocity and the level of sensor support on the defended area from a single interceptor site against a long range theater ballistic missile (3,000 km range). The faster the interceptor the farther it can fly out to intercept the ballistic missiles increasing the defended area from a given interceptor site.

Ballistic
Missile
Defense
Organization

HOMELAND DEFENSE CAPABILITY AGAINST NORTHERLY THREATS

- Single Site At Grand Forks, ND
  - Ground Based Interceptors (GBI)
  - Ground Based Radar (GBR)
  - Brilliant Eyes (BE)



■ No Coverage

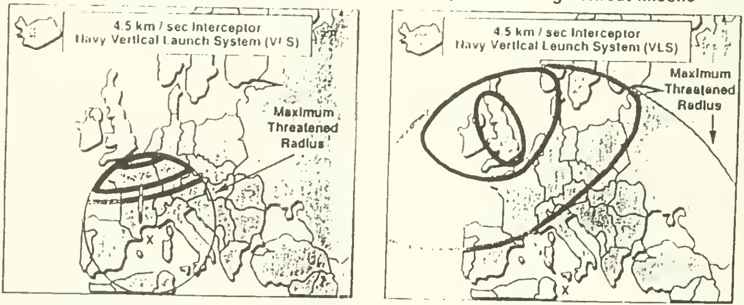
▨ Intercept Supported By BE Only

☐ Intercept Supported By BE And GBR

Ballistic
Missile
Defense
Organization

BRILLIANT EYES INCREASES BALLISTIC MISSILE DEFENSE AREA

- Greater Enhancement For Threats Launched Beyond Radar Coverage


4.5 km / sec Interceptor
Navy Vertical Launch System (VLS)
Maximum Threatened Radius
X
4.5 km / sec Interceptor
Navy Vertical Launch System (VLS)
Maximum Threatened Radius
X

1,000 km Range Threat Missile

3,000 km Range Threat Missile

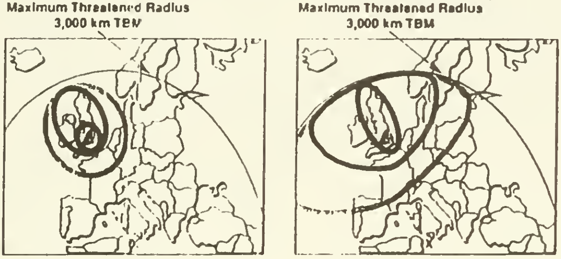
Defended Area Footprints

▬ Radar Commit
▬ Cued Radar Commit
▬ BE Commit

First Shot Opportunity Contours

BRILLIANT EYES MAXIMIZES MISSILE PERFORMANCE

- Defended Area Becomes Dependent On Defense Interceptor Performance
  - Increases Defended Area
  - Enables Defense From Greater Standoff Ranges



2.7 km / sec THAAD

4.5 km / sec Interceptor

Defended Area Footprints

▬ Radar Commit
▬ Cued Radar Commit
▬ BE Commit

First Shot Opportunity Contours

Question. Describe the infrared capabilities of these sensors, and how this compliments ground-based and space-based radar information about enemy warheads.

Answer. Brilliant Eyes (BE) satellites carry a suite of passive sensors including short-, medium- (narrow and wide band), and long-wavelength infrared (SWIR, MWIR and LWIR) and visible light sensors to acquire and track targets. The SWIR and MWIR (narrow band) are designed for plume detection during the boost phase of the ballistic missile trajectory. The MWIR (wide band), LWIR and visible sensors track the missiles after burnout and throughout the midcourse phase of the missile trajectory. BE acquires and tracks ballistic missiles long before the ground-based radars acquire the missiles allowing interceptors to be launched sooner providing the maximum defended areas by a given interceptor system.

During the midcourse phase before the ground-based radars acquire and track the missiles, the LWIR and visible waveband sensors are capable of accurately tracking the midcourse objects and providing radiometric and metric data to support discrimination of the warheads from debris and penetration aids and state vectors necessary to support interceptor launches and in-flight updates. Later, when the ground based radar is tracking and measuring the dynamics of the threat objects with tremendous precision, the passive infrared sensors are measuring the emitted radiation which is indicative of the size, temperature, surface material, shape and dynamics of the object. These passive infrared sensors compliment the active radar because the countermeasures necessary to interfere with these two distinctly different portions of the electromagnetic spectrum are very different. Also, the inclusion of the visible light sensor on BE which responds to the reflected sunlight off the objects adds yet a third dimension because countermeasures to reduce the visible signature of objects increase their infrared signature. Therefore, against two synergistic passive sensor wavebands and the active radar the enemy must employ two kinds of countermeasures at additional development cost and penalty to the offensive payloads to try and counter both types of sensors.

Also, the fusion of both types of data increases the target state vector accuracy and supports very powerful discrimination techniques which can better differentiate the lethal from non-lethal objects than either sensor can on its own.

Question. What is the acquisition strategy and key milestones?

Answer. BE is the second phase of the Demonstration and Validation program with contract award on 11 December 1992 to Rockwell and TRW. Both contracts are cost-plus award fee contracts to design the operational system, perform ground demonstrations and experiments of sensors and critical technologies and fly two satellites by each contractor by FY 1998 to demonstrate critical functional and performance issues supporting a Milestone II decision. Following Milestone II in FY 1998, one contractor will complete the detailed operational design and produce low rate initial production (LRIP) satellites for launches beginning in FY 2002. The current schedule is funding limited and changes will depend on results from the OSD Policy and Strategy Review.

Question. How much technical risk is involved in the development program?

Answer. In 1991 the Brilliant Eyes program established a risk management working group involving Air Force and, BMDO, supported by Aerospace Corporation, NASA/JPL and contractor personnel to evaluate the technical as well as engineering, developmental, manufacturing, and production risk of every subsystem in Brilliant Eyes. Over 50 satellite subsystems have been examined in major categories. Each of these areas has been rated based on the evaluation methods used by BMDO and the Air Force based on Defense Management System College methods. Based on BMDO and Air Force risk assessment, the overall program is at a moderate risk level. The few components at moderate/high risk levels have parallel technology development and test programs to reduce risk.

OSD performed an independent risk assessment in 1992 and found the overall program to be of moderate risk. Program risk is also mitigated by having two competing contractors in Dem/Val and numerous parallel technology development efforts for the critical subsystems.

Question. What are the ABM Treaty implications for Brilliant Eyes?

Answer. The U.S. has begun a comprehensive examination of U.S. ballistic missile defense policy and objectives and related ABM Treaty issues. This review, which should be completed in the near future, will provide the basis for U.S. decisions on our options for ballistic missile defenses, including the need for modification of the ABM Treaty, if any. At the completion of the study, we will be able to provide a more complete description of the ABM Treaty implications for Brilliant Eyes.

Question. Provide for the record a detailed description of how the fiscal year 1994 funds will be used, and an estimated total cost for this program.

Answer. The FY94 funds will be used primarily to fund the two prime contractors—Rockwell and TRW—to complete their detailed designs of the Dem/Val satellites, perform ground demonstrations, and purchase flight hardware for the Dem/Val satellites. Additionally, the money will fund required technology developments and demonstrations (cryocoolers and sensors), test support (sensor test facilities at Arnold Engineering and Development Center), and program office operations. The estimated total acquisition cost for the BE program (Strategic and Theater) is about $5.6B (Then Yr $) for approximately 40 satellites.

TACTICAL BALLISTIC MISSILE THREAT

Question. Iraq's use of tactical ballistic missiles (SCUDs) in the recent Gulf conflict ushered in a sinister new type of warfare. How many countries today possess tactical ballistic missiles? Specifically, which countries?

Answer. Today, there are countries other than the United States, its NATO allies, and the former Soviet Union that possess tactical ballistic missiles. These countries are:

[Clerk's note.—Classified insert removed.]

Question. How is the threat expected to change during the next ten years?

Answer. DCI Woolsey testified that "After the turn of the century, some countries that are hostile to the United States might be able to acquire ballistic missiles that could threaten the continental United States." He went on to state that "over the next ten years we are likely to see several Third World countries at least establish the infrastructure and develop the technical knowledge that is necessary to undertake ICBM and space launch vehicle development." DCI Woolsey also warned, however, that such countries could truncate this development period through the acquisition of key production technologies and technical expertise or by covertly purchasing such systems.

Former DCI Gates and DCI Woolsey made the following points in their testimony before Congress:

1. We will see weapons in the Third World with technical capabilities that could challenge U.S. defenses.
2. U.S. or Multinational forces deployed abroad could face increased threat of air-delivered nuclear weapons before the end of the decade.
3. Several countries now have, and others are likely to field some ballistic missiles with nuclear warheads in the coming years, and this could soon become a nuclear threat.
4. Most major countries in the Middle East have chemical weapon development programs and some already have stockpiles that could be used.
5. China and North Korea may sell other countries longer-range missiles and the technologies necessary to produce them.
6. A special weapons arms race is already underway in Middle East and South Asia.
7. Many countries, from North Africa through South Asia, will equip their delivery systems to carry weapons of mass destruction in the next decade.
8. Potential for technological surprise in Third World is growing as some international restrictions on foreign access to dual use technologies are loosened.
9. Iraq is still a great challenge and will remain a primary proliferation threat as long as Saddam remains in power.
10. Iran has embarked and will probably continue an across-the-board effort to develop its military and defense industries including nuclear weapons. Iran probably will take at least eight to ten years to produce its own nuclear weapons, perhaps fewer years if it receives critical foreign assistance for its development effort. Iran will continue its active chemical warfare program.
11. Syria has turned to North Korea and China for extended range missiles and for reactor capabilities.
12. Israel, Saudi Arabia, and Egypt have decided recently to strengthen their deterrent and defensive capabilities as a hedge against long term threats from Iran and resurgent Iraq.
13. Libya has a major chemical weapons program and is trying to build a biological facility. Libya will continue to diligently shop throughout the world for a source of longer range missiles to reach across the Mediterranean Sea to Europe.
14. The arms race between Pakistan and India will continue. Both countries have nuclear weapon and ballistic missile programs. Both countries will pursue chemical weapons in the future.
15. North Korea's nuclear program is of great concern. The purpose of its two nuclear reactors is to produce plutonium.

16. China has developed two solid fuel SRBMs (M–9 & M–11) that exceed the range and payload limits of the Missile Technology Control Regime (MTCR). China will most likely continue to be a supplier of nuclear technology to the Third World.

Question. What are the typical performance capabilities that we expect to face from such missiles? How does this compare to the Iraqi Scud?

Answer. Although the threat includes both unguided (artillery rockets) and guided ballistic missiles with ranges between 40 and 3,000 km, it is the guided ballistic missiles that are generally thought of as the tactical ballistic missile threat. Such guided missiles typically have ranges between 120 and 3,000 km, reentry vehicle masses between 300 and 1,000 kg, reentry velocities between 1 and 4 km/sec, and accuracies varying from 50-to-1,000 m circular error probable (CEP). The Iraqi-modified Scud with its 600-to-650 km range falls within this grouping; however, its assessed CEP of 1,500-to-1,900 m makes it somewhat less accurate.

Question. Describe the threat of chemical- or biological-agent warheads launched from tactical ballistic missiles.

Answer. ———

STRATEGY FOR THEATER DEFENSES

Question. The theater defense portion of the SDI program envisions development of a number of ground missiles, radars, and C3 to supplement Patriot in the anti-ballistic missile mode. General O'Neill, what is your acquisition strategy for tactical ballistic missile defense?

Awswer. The emphasis and criteria in the selection and acquisition of the TBMD elements and systems will be focused first on upgrading existing capabilities of PATRIOT and AEGIS and then, on achieving a major increment of improvement, via the new start Theater High Altitude Area Defense (THAAD) system. This new system has an early capability called a User Operational Evaluation System (UOES). The other key aspects of the acquisition strategy are to proceed with low-to-moderate concurrency and risk, and to leverage technology to the maximum extent possible.

The complexity of the acquisition is based upon the requirements that the TMD system must: be designed and configured to handle diverse, challenging, and evolving threats; operate in a variety of operational environments under a wide range of scenarios; accommodate new elements and systems from different Services; and integrate with an existing CINC command structure with existing capabilities and systems, many of which were designed to provide other functions.

To implement this complex acquisition, special organizational relationships and responsibilities have been adopted. Under the General Manager, the Deputy for TMD provides central DoD management, direction, system engineering and integration, element selection, and allocation of funding for the TMDI. The Services, and acting as executing agents, implement the associated acquisition and inter-Service integration activities for individual elements and C31, sensor, and weapon capabilities.

An integral part of the acquisition strategy is a focus on early demonstration, test, and evaluation with a strong emphasis on simulation. In the very near term, a program to add TMD aspects to CINC exercises for training and doctrine development and to achieve early capability demonstrations and integration of multi-Service TMD systems is underway. This effort will also provide interim improvements in TMD and lay the groundwork for future upgrades.

A major simulation, test, and evaluation program is already underway. This incudes several test bed developments, and integration and use of the National Tests Facility (NTF) and National Test Bed (NTB). A test and evaluation Master Plan (TEMP) is being prepared for this activity.

Below is a table showing TMDI active defense candidate capabilities:

Capability	Near term	Mid term	Far term
Lower-tier, grnd-based intercept.	PAC–2 upgraded HAWK (USMC).	PAC–3	Corps SAM.
Lower-tier, sea/based intercept		SM–2 Blk IV A, SPY–1 Mod	
Upper-tier, grnd-based intercept.		THAAD UOES, TMD–GBR UOES	THAAD, TMD–GBR.
Upper-tier, sea-based intercept			Sea-based TMD intrcpt; SPY–1 upgrade.
Boost phase intercept		Air launched interceptor prototype.	BPI (Obj.)
Warning & surveil	TPS–59: Tactical DSP processing.		Brill. Eyes.
C3I	Launch detect.: Standardized interfaces.	AEGIS BMC3 Mod; Surveillance data netting; Communication, upgrades.	Theater cmd center mods; AEGIS BMC3 upgrades; Cooperative engagement.

Question. What performance characteristics are required in the new U.S. System? Discuss how Patriot upgrades, the Israeli Arrow missile, SDI's ERINT missile, and new missiles (Like "CORP SAM" or THAAD") are related. Discuss how Patriot upgrades, the Israeli Arrow missile, SDI's ERINT missile, and new missiles (like "CORP SAM" or "THAAD") are related.

Answer. The TMDI has formulated a set of 17 characteristics grouped into four operational areas.

Deployment.—Capable of quick and easy movement by air; capable of forward deployment by ship in the crisis area; and available for rapid utilization after deployment.

Employment.—Flexible to accommodate a wide range of operational locations and scenarios; capable of tactical movement with troops and mobile military assets on the battlefield; and able to achieve a high degree of availability and sustainability provided with inherent survivability features in a variety of nuclear, biological, and chemical (NBC) environments.

Effectiveness.—Provide early and accurate launch detection and impact point protection for civil and military units; protection for civil and military units; provide extended surveillance ranges and altitudes; provide low leakage defense of assets and areas; provide a preferential defense capability; be effective against a range of TBM threats and resistant to enemy countermeasures; and intercept missiles high enough to minimize effects from NBC debris.

Integration.—With CINC and National Command Authority structure; with theater offensive operations; with theater air defense operations; and to the extent possible with C3I of allies or coalition partners.

On the basis of these characteristics, a framework for the TMD architecture has been formulated in terms of five broad capability areas:

(1) A lower tier (terminal, endo-atmospheric) intercept capability with both air transportable and sea-deployable capabilities to defend point and limited area asset targets.

(2) An upper tier (midcourse, high endo/low exo-atmospheric) intercept capability with both air transportable and sea-deployable capabilities to extend intercept envelopes, provide broader area defense, assure multiple intercept opportunities, and minimize the ground effects of unconventional weapons.

(3) Capability for boost phase intercept (BPI) or intercept in early phase of flight to destroy missiles equipped with countermeasures and/or clustered warheads before their release or to destroy attacking missiles over the attacker's territory.

(4) Enhanced warning and surveillance capabilities including fixed and mobile tactical processing of launch detection data (from the Defense Support Program (DSP), follow-on early warning system (FEWS), or other means) extended midcourse tracking, and netted surveillance to support intercepts and broader defense coverage.

(5) Command, control, communications, and intelligence (C3I) capabilities to tie together and manage the above intercept and surveillance/warning capabilities and to integrate and coordinate TMD functions with the ballistic missile defense elements under study as part of the NMD.

A brief description of elements (systems) under consideration for each capability area is presented below.

Lower Tier Intercept: Patriot upgrades, including ERINT; improvements to the Marine Corps TPS–59 radar and HAWK weapons system; Corps SAM; and upgrades to the Navy's AEGIS system, including the SPY–1 radar, SM–2 Block IV A; and battle management and C3I subsystems.

Upper Tier Intercept: THAAD with TMD–GBR, and sea-based systems utilizing either THAAD, LEAP-based interceptors, or other long-range interceptor concepts.

Boost Phase Intercept: A number of BPI possibilities incorporating various airborne and surface-based platforms and weapons have been suggested. A study of the concepts and technological possibilities is currently underway, along with a program exploring RAPTOR TALON, an unmanned autonomous vehicle (UAV) with a kinetic energy weapon.

Warning and Surveillance: Tactical processing of launch detection data is available from Talon Shield, Radiant Ivory, Tactical Surveillance Demonstration (TSD), and the Joint Tactical Ground Station (JTGS); Brilliant Eyes is a longer-term addition for increasing surveillance ranges, improving cueing accuracy, extending interceptor engagement ranges, and attaining worldwide surveillance.

C3I: Standardization of TMD messages; expanded use of the Tactical Information Broadcast System (TIBS), the Tactical Receiver and Related Applications (TRAP), and the Joint Tactical Information Distribution System (JTIDS); upgrades to the Air Force Control and Reporting Center (CRC); and development of an Army Air Defense Tactical Operations Center (ADTOC).

The elements are in various stages of definition, development, and acquisition. Some are large efforts and fall (or will fall) under the cognizance of the Defense Acquisition Board (DAB); others are smaller efforts. Some are already in the demonstration and validation (Dem/Val) phase; some are in concept formulation or definition.

Three time periods have been selected to provide a time-phased reference for possible improvements to TMD capabilities. In the near term (FY 93–95), upgrades to Patriot PAC–2 and missile defense capabilities of the Marine Corps are programmed. Improved tactical processing and dissemination of launch detection data is already underway.

In the mid term (FY 96–99), PAC–3 upgrades will further improve the Patriot system. This may include enhancements from the ERINT program or Patriot multimode missile. A sea-based PAC-3-like capability utilizing AEGIS and the Navy's existing Vertical Launch System (VLS) to defend debarkation ports, coastal airfields, amphibious objective areas, and expeditionary forces as they are inserted ashore could be added.

Also in the mid term, and to move beyond the inherent limitations of a point or limited area defense system, wide-area coverage using the THAAD interceptor system, including the TMD Ground-based Radar (TMD–GBR), will be added. To respond to the Missile Defense Act mandate for fielding an advanced TMD capability by the mid-1990s, a prototype THAAD "battery" or UOES will be provided at the end of the Dem/Val in 1996 for early operational assessment and possible deployment if a contingency requirement arises. Provision of the UOES is a major current thrust and priority of the TMDI.

In the far term (FY 2000+), a sea-based TMD capability utilizing a longer-range missile could become available and could provide extended theater-wide footprints. The availability of Brilliant Eyes (the space-based sensor) could enhance the coverage of theater missile defenses by extending the range of THAAD and Navy interceptors by providing accurate midcourse cueing. Additional TMD capabilities could be added to the architecture in the form of the short-range Corps SAM and boost phase interceptors.

The ARROW is an Israeli-developed missile that was designed to counter current and projected tactical ballistic missile threats facing Israel. The operational and technical requirements for the ARROW are dramatically different than requirements applicable to U.S. interceptors. U.S. anti-tactical ballistic missiles must be air transportable for rapid deployment worldwide and capable of countering the full spectrum of tactical ballistic missile threats present in all regions of the world.

Question. How much will the entire Tactical Ballistic Missile Defense initiative cost? For the record, provide a breakout by fiscal year, and category of cost.

Answer. We are awaiting the results of the bottom-up review which will determine the architecture and schedule that will comprise the entire Tactical Ballistic Missile Initiative.

The current acquisition cost estimate for those Theater Missile Defense acquisition programs that are currently under DAB purview and are included within the FY 1994 BMDO budget request, in billions of FY88 dollars and then-year (TY) dollars, are as follows:

	FY88	Then-Year
Command and Control Element	.161	.223
Systems Engineering & Integration	.061	.081
System Test & Evaluation	.147	.215
Brilliant Eyes	.959	1.351
Upper Tier Theater Missile Defense (UTTMD)	6.388	8.858
Theater High Altitude Air Defense (THAAD)	(4.153)	(5.741)
TMD Ground-based Radar (TMD–GBR)	(2.235)	(3.117)
Corps Surface-to-Air Missile (Corps SAM)	3.429	5.089
Phased Array Track Radar Intercept of Target (PATRIOT)	2.385	3.161
Subtotal	[1] 13.531	18.978

[1] Figures may not add due to rounding.

Acquisition costs include those costs funded either through the RDT&E, procurement, or military construction appropriations to provide a new or improved capability. Acquisition costs for BMDO elements primarily comprise the Demonstration and Validation (Dem/Val), Engineering and Manufacturing Development (EMD), and Production phases. Funding for development of technology not specific to an element are not included in BMDO acquisition costs, as well as programs such as the Navy TMD initiative that are not yet in a formal acquisition program.

Below is a breakout of TMD FY 1992–1994 funding by fiscal year and category of cost. Out year funding is not shown pending results of the bottoms-up review.

Category	Fiscal year,		
	1992 actual	1993 estimated	1994 estimated
SYSTEMS DEVELOPMENT			
Acquisition:			
2102 BE	0	0	112.5
2104 GBR	42.0	111.9	234.1
2207 PATRIOT	159.9	169.7	249.9
2208 ERINT	160.0	116.9	97.7
2210 THAAD	75.0	273.0	484.3
2212 Corps SAM	23.0	23.0	32.0
3304 Targets	29.9	39.8	64.0
Subtotal	489.8	734.3	1,274.5
Pre Acquisition:			
1210 Navy LEAP	0	30.0	93.8
2213 Navy/Marine Corps TMD	0	67.0	159.2

Category	Fiscal year,		
	1992 actual	1993 estimated	1994 estimated
Subtotal	0	97.0	253.0
RISK MITIGATION, HEDGES, AND PI			
1206 Advanced TMD Weapons	20.3	6.1	6.0
2106 ACTS	32.1	70.2	45.4
2203 E2I	13.8	0	0
2209 ACES	60.0	57.8	56.4
3212 Passive Defense	1.0	0	0
3213 Active Defense	6.0	0.2	9.8
Subtotal	133.2	134.3	117.6
THREAT EVALUATION, PHENOMENOLOGY, AND OTHER SUPPORT			
1105 Discrimination	1.0	0	0
1106 Sens Stud & Exp	3.0	5.7	.6
1109 TMD Discrimination	11.5	11.4	1.3
1501 Survivability	4.4	3.1	3.0
1502 Leth & Tgt Hard	17.7	28.0	35.1
3204 Countermeasures Integ	4.9	0	0
3205 TMD Spec Studies	74.5	28.5	31.4
3207 System Analysis	0	1.0	1.0
3208 Integ & Balancing	6.8	4.6	4.4
3210 Counterforce	3.9	2.6	3.9
3211 C4I & Ops Anal	14.6	8.8	14.7
3301 Data Center	0	0	3.7
3305 Theater Test Bed	55.6	40.9	38.3
3310 T&E Facil/Launch	0	1.0	10.0
3311 Mobil Test Assets	0	0.3	0
3313 Test Ranges	0	0.7	14.9
4000 Operational Support	0.9	0.3	0
Subtotal	198.8	136.9	162.3
Total	821.8	1,102.5	1,807.4

Question. Discuss key testing and fielding dates. When will U.S. troops have this capability? When is IOC (Initial Operating Capability)? When is FOC (Full Operating Capability)?

Answer. Below is the schedule for TMDI key events. These dates may change as a result of the Secretary's Bottoms-Up Review. Final operational capability dates have not been included because they have not been established.

Patriot PAC–2	First Unit Equipped (FUE) [1]	4Q93.
Patriot PAC–3	MS IV Review	3Q98.
Patriot PAC–3	Missile FUE	3Q98.
Corps SAM	MS I	4Q93.
	Early Developmental Testing	2Q95–1Q98.
	Early User T&E/OEA	3Q97–2Q98.
	Follow-on DT&E/OA	2Q00–2Q01.
	LRIP Review	1Q01.
	IOT&E	1Q02.
	MS III	4Q02.
	IOC	2005.
THAAD	Initial Design Review	2Q93.
	Final Design Review	4Q93.
	Missile Flight Tests (10)	4Q94–4Q95.

	System Flight Tests (10)	4Q95–4Q96.
	MS II Review	4Q96.
	LRIP	2Q99.
	IOC	4Q01.
	MS III Review	1Q02.
TMD-GBR	Testbed Critical Design Review (CDR)	3Q93.
	System CDR	2Q94.
	Testing w/THAAD	4Q94–4Q96.
	MS II Review	4Q96.
	LRIP Review	2Q99.
	IOC	4Q01.
	MS III Review	1Q02.
USMC Hawk/TPS–59	Developmental Testing	4Q95.
	Operational Testing	1Q96.
	IOT&E	1Q97.
AEGIS/SM–2 Block IV A	MS IV Review	3Q94.
	UOES	4Q97.
	FUE	2Q99.
Sea-Based TBMD	MS I Review	3Q95.
	UOES	2Q00.
	FUE	2Q02.
ACES [2]	Arrow I Flight Test (4)	2Q93–4Q93.
	IIT Flight	1Q94.
	Arrow II Flight Test (6)	3Q94–3Q95.
	Israeli FSD Decision	1Q95.
	ACES Final Report	3Q95.

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[1] Initial operating capability (IOC) for systems already fielded.
[2] Note: This is not a system the U.S. will field.

ARROW MISSILE

Question. The fiscal year 1994 budget requests $56 million in fiscal year 1994 to continue development of the Israeli Arrow missile program. Test results initially were not encouraging. General O'Neill, describe our involvement in the Arrow program. What's in it for the U.S. government?

Answer. The Arrow program was an SDIO cooperative, cost-shared program with Israel during 1988–1992 that developed and tested the Arrow I missile to demonstrate the feasibility of intercepting a tactical ballistic missile (TBM) target. The Arrow program concluded with the fourth flight test on September 23, 1992. Although the four test flights under the Arrow program had some technical difficulties, we received very valuable information about the physics and engineering of TBM interceptors from studying these technical problems. This information will be directly applicable and available to U.S. ATBM programs. The technical solutions to the problems encountered in these first four Arrow tests were applied to the first ACES test, a successful flight. As with the Arrow tests, lessons learned in the ACES program will significantly benefit the U.S. THAAD program.

Question. Describe work done to date by the U.S. government on Arrow. What have been the test results?

Answer. The U.S.-Israel cooperative ARROW program, as set forth in the respective memorandums of agreement (MOA) of the ongoing ARROW Continuation Experiments (ACES) and its predecessor ARROW program, is directed by the Ballistic Missile Defense Organization (formerly the Strategic Defense Initiative Organization) and implemented by the U.S. Army Space and Strategic Defense Command (USASSDC). In accordance with the provisions of the MOA, the actual execution of work, such as ARROW design, development, and construction, is accomplished by Israel Aircraft Industries, Ltd., which was issued a firm fixed price contract by USASSDC.

With regard to the ARROW flight tests, the initial ARROW program was completed with the fourth flight test that was conducted in September 1992. Of the four test flights, the first was destroyed early in flight due to ground instrumentation error and the following two tests provided useful data in spite of experiencing technical shortcomings prior to completion of their entire flight. The fourth test, a successful test flight, achieved its objectives and validated the modifications indicated by the previous tests.

The first flight test under the follow-on ACES program was conducted in February 1993. While the ARROW missile passed within lethal distance of the target missile, the warhead did not detonate. The malfunction was identified during the post-test flight analysis and has been corrected in preparation for subsequent ARROW test flights.

Question. Explain the current cost-sharing arrangement?

Answer. Arrow cost share: 80% U.S./20% Israel; ACES cost share: 72% U.S./28% Israel.

Question. What is the plan for the next phase of the program, called "ACES" (Arrow Continuation Experiment Series)? How much will ACES cost in total? What are the program milestones?

Answer. Initiated in July 1991, the ARROW Continuation Experiments (ACES) program, a 45-month effort, is designed to conduct a series of tests using the ARROW I interceptor that was developed under the earlier ARROW program, and to design and test a smaller, more capable interceptor, the ARROW II. The program has two phases: (1) four initial flight tests to intercept surrogate targets using the ARROW I missile with an aimable warhead against simulated chemical warheads; and (2) seven subsequent flight tests to test the ARROW II missile, including six flight intercepts of surrogate targets.

The U.S. cost for ACES will total $216M. Program milestones include the ARROW II Critical Design Review, conduct of ARROW II test flights, completion of structures and avionics systems production, and completion of ARROW II system integration.

Question. Under what conditions would the U.S. actually buy the Arrow for use by U.S. forces?

Answer. The U.S. has no operational requirement for the ARROW and has no plans to purchase it. The purpose of the cooperative program is to contribute technology and data to the development of U.S. interceptors and concurrently, satisfy the Israeli requirement for development of a tactical ballistic interceptor. The ARROW is an Israeli-developed missile that was designed to counter current and projected tactical ballistic missile threats facing Israel. The operational and technical requirements for the ARROW are dramatically different than requirements applicable to U.S. interceptors. U.S. anti-tactical ballistic missiles must be air transportable for rapid deployment worldwide and capable of countering the full spectrum of tactical ballistic missile threats present in all regions of the world.

Question. Provide for the record a detailed breakout for the use of FY 1994 funds.

Answer. Prime Contract (IAI):

Test plans	8.0
Fabricate motors	4.0
Fabricate structures	3.0
Integrate three missiles	16.0
Conduct integration flight test	9.0
Conduct two interception flight tests	10.0
Total	50.0
U.S. Support Contracts	6.4

PATRIOT MISSILE UPGRADE

Question. The fiscal year 1994 budget requests $81 million in R&D and $121 million in procurement for Patriot upgrades funded by SDIO (in addition to those funded by the Army). What is the agreement between SDIO and the Army concerning responsibility for Patriot upgrades? Discuss what specific changes you have in mind for Patriot, how these increase its anti-TBM capability, and the timeframes involved. What is the plan for fielding these upgrades, assuming the development is successful? What percentage of Patriot units will receive such upgrades?

Answer. In addition to providing the ground-based lower tier of the current theater missile defense (TMD) capability, PATRIOT must continue to provide air defense for the Army's echelon-above-corps requirements. Consequently, the Army and BMDO are now planning and funding a series of improvements that will culminate in the PATRIOT Advanced Capability, Phase 3 (PAC–3) system, a growth program essential to maintain PATRIOT's capability against current and projected air-breathing and ballistic missile threats to U.S. and Allied forces. The chart at the end of this statement shows the breakout of Army and TMDI funding for these PATRIOT improvements.

The PAC–3 upgrade is a combination of carefully coordinated improvements to the PATRIOT radar, missile, control station, and communications equipment that will meet the requirements of the PAC–3 Operational Requirements Document (ORD). These improvements are managed under the Army's Material Change Process. The designated decision authority for PAC–3 is the Army Program Executive Officer (PEO) for missile defense. All PAC–3 improvements are reviewed and approved by the Army Service Acquisition Review Council (ASARC) and Defense Acquisition Board (DAB) due to the estimated total R&D and production costs. The U. S. Army Deputy Chief of Staff for Operations and Plans will determine the PATRIOT fielding timing and missile distribution to specific units.

Improvements to the radar and ground equipment are low technical risk and now are in the process of engineering development. The PAC–3 missile improvement is a major engineering change. Two material alternatives are being considered for the PAC–3 missile, the Multimode Missile (MMM) and the Extended Range Interceptor (ERINT). The MMM is built by Raytheon and is a major electronic and propulsion upgrade of the current PATRIOT missile. ERINT is built by Loral Vought Systems Corporation and is a new missile that BMDO is developing as an advanced technology demonstration. ERINT development began in 1986.

BMDO manages the PAC-3 upgrade efforts through several vehicles. Program Management Agreements between BMDO General Manager and the Army PEO for missile defense formalizes the tasks and funding allocations to execute the upgrade program. BMDO also ensures that its concerns are voiced and acted on by holding voting membership on the ASARC, by participating in program reviews, and by formally reviewing associated acquisition and programmatic documents.

The following table breaks out the major components of the PATRIOT improvement effort.

Growth PGM and capability	Fund by	Status
PATRIOT Quick Response Program (QRP):		
Remote Launch: Remote launchers out to 12–13 km	Army	Deployed SWA.
Emplacement Enhancements: GPS and North Finding System to provide automatic, day/night position & azimuth determination for rapid, accurate fire unit emplacement in all weather & operational environments	Army	Deployed SWA.
Radar Enhancements:		
Incorporates low noise receiver to increase signal-to-noise ratio & reduce miss distance with PAC-2 missile	Army	Deployed SWA.
Antenna sidelobe reduction to increase survivability against antiradiation missiles and electromagnetic exploitation	Army	Deployed SWA.
Radar Shroud: Reduces radio-frequency interference such as false targets & friendly jam strobes received from the backlobe of the antenna	Army	Deployed SWA.
PATRIOT Configuration 1:		
Expanded Weapons Control Console (EWCC): Provides four times the throughput & four times the memory of current WCC; support future PAC-3 improvements	Army	Developmental testing.
Optical Disk (Data Recorder): Provides greater memory storage capacity, improved system recovery time & improved storage medium access time	Army	Developmental testing.
Guidance Enhancement Missile: Low noise receiver & improved fuze increases missile ATBM performance	BMDO	Developmental testing.
PATRIOT Configuration 2 (First unit in FY96):		
Multimode Missile/ERINT: Increases missile performance (range & altitude of engagements & probability of kill)	BMDO	Developmental testing.
Radar Enhancements, Phase 2: Pulse Doppler processor improves target discrimination in clutter	Army	In production.
Comm. Upgrades: Provides hardware for HTIDS/MSE interoperability (with AWACS, CEC, Allied Forces, etc.)	BMDO and Army	Development.
PATRIOT Configuration 3 (First unit in FY98–99):		
Radar Enhancements, Phase 3: Dual TWT transmitters & improved exciter increases the radar's multifunction capability & surveillance range	BMDO	Development.
Remote Lnch, Phase 3: Extends remote launch capability to 30–40 km	BMDO	Development.

MULTIMODE MISSILE

The PATRIOT MMM consists of several interdependent upgrades to the active radio frequency (RF) seeker, warhead, and propulsion subsystems. The MMM provides improved guidance accuracy and target angle resolution that enable the PAC-3 MMM to intercept TBM targets at higher altitudes than the current missiles. In addition, the MMM provides improved performance against low altitude cruise missiles and increased motor performance resulting in greater burn-out velocities and reduced time to target.

The MMM Seeker Demonstration program has successfully completed two live firings against an unaugmented MQM–107 drone (air-breathing target) and a surrogate TBM (PATRIOT was used as a target). These firings have successfully demonstrated transition to Ka-band active guidance, high data rate active guidance, interleaved C/Ka-band guidance, and an active seeker integrated fuze. The program did experience one in-flight failure. The remaining flight is scheduled against a stressing TBM target (STORM) in the near future. Four MMM missiles will fit in the standard PATRIOT launcher.

ERINT MISSILE

The ERINT missile is a small, highly agile interceptor that achieves target warhead kill by direct missile-to-missile impact (hit-to-kill). The ERINT missile is initially guided by aerodynamic fins that fly it to a predicted impact point. In terminal flight phase, an onboard active radar Ka-band RF seeker acquires the target and provides instantaneous target position data to an onboard guidance processor. The processor develops the homing guidance commands required to achieve hit-to-kill. Small solid rocket thrusters mounted near the vehicle's nose steer the missile to a body-to-body impact resulting in a high lethality.

The ERINT flight program consists of two control test flights, three guided test flights against surrogate ballistic targets, an aircraft drone, and two guided flight tests against a surrogate maneuvering tactical missile. Two control flights have been completed successfully. These flights validated all subsystem performance and models except for the Ka-band seeker. The first guided intercept flight is scheduled for May 93. Sixteen ERINT missiles can be mounted on a Patriot launcher.

MISSILE REQUIREMENTS AND SELECTION PROCESS

The PATRIOT and ERINT Program Managers report to the PEO for missile defense. The selection process between MMM and ERINT was developed to provide the basis for making an informed trade-off decision within affordability constraints and operational requirements. A PAC–3 Missile Review Board has been established that will assess the cost, performance, risk, and operational characteristics of each of the missile alternatives and develop a recommended PAC–3 missile approach. A Senior Review Committee consisting of General Officers and Senior Executive Members has been established to review the Board findings and develop a recommendation to be carried forward to the Milestone Decision Authorities.

An initial (Phase I) PAC–3 Cost and Operational Effectiveness Analysis (COEA) conducted in August 1992 concluded that only one missile, MMM or ERINT will be selected to proceed into production and deployment. A special Army Systems Acquisition Review Board convened on May 19, 1993, approved a strategy of continuing the nonselected PAC–3 missile candidate for further evaluation of its technologies for the purpose of mitigating technical risk.

The PAC–3 missile will be selected following the completion of the second phase of the PAC–3 COEA. The COEA will provide data to support the following key questions:

What tactical ballistic missile battlespace can each missile achieve against conventional and chemical unitary and submunition warheads?

What are the air defense artillery contribution of each system with respect to both chemical and conventional TBM munitions?

What are the life-cycle costs and significant cost-drivers associated with each missile?

An independent missile evaluation board chartered by the Army is examining the cost, risk, operational, and performance of both missile candidates. The evaluation board will make its recommendation to the Senior Advisory Council (SAC) composed of senior Army and BMDO leadership. The SAC approves the evaluation criteria, factors, and analysis methodology. It will make the final recommendation to the ASARC. This recommendation will then be forwarded to the BMDO Acquisition Review Council, and finally to a DAB. Flight test results and extensive six degree-of-freedom simulations coupled with hardware-in-the-loop testing will support the decision process. This process mandates objective decision method and criteria.

Below is a breakout of Army and TMDI funding for PATRIOT improvements.

	FY93	FY94	Total (FY93–FY99)
Army:			
RDT&E	36.3	37.7	143.1
Prc/Sprs	39.9	80.7	311.3
Sustain	598.9	721.3	4,910.4
Army total	675.1	839.7	5,364.8
BMDO/TMDI:			
RDT&E	94.5	129.2	555.1
Prc/Sprs	75.2	120.7	2,002.5
TMDI total	169.7	249.9	2,557.6

Question. How much will these upgrades cost in total to develop and procure? Provide a detailed breakout for the record. Provide a breakout for the use of FY 1994 funds for the record.

Answer. Below is a breakout of Army and TMDI funding for Patriot improvements.

	FY93	FY94	Total (FY93–FY99)
Army:			
RDT&E	36.3	37.7	143.1
Prc/Sprs	39.9	80.7	311.3
Sustain	598.9	721.3	4,910.4
Army Total	675.1	839.7	5,354.7

	FY93	FY94	Total (FY93–FY99)
BMDO/TMDI:			
RDT&E	94.5	129.2	555.1
Prc/Sprs	75.2	120.7	2,002.5
TMDI Total	169.7	249.9	2,557.6

Preliminary PATRIOT Missile Upgrade FY94 Operating Program

[In millions of dollars]

6.3:	
Remote Launch	3.2
Radar Phase 3	22.5
Multimode Missile	55.0
6.4: PAC–3 EMD	48.5
Procurement:	
Radar Enhancement (QRP)	14.0
Procurement Support	99.5
Routing Logic Radio Interface Unit Mod.	7.2
Total	249.9

For FY94, Army RDT&E is primarily funding communications upgrades and Classification, Discrimination, and Identification (CDI) programs.

Procurement/Spares are for upgrades to the Weapons Control Console. Sustainment Costs are for contractor and government engineering, integrated logistics support, software support, etc.

BMDO RDT&E in FY94 is primarily for Radar Enhancements Phase III development and PAC–3 missile Engineering and Manufacturing Development.

Procurement/Spares are for Radar Enhancements Quick Response Program (QRP) and RLRIU. Also included are support costs which share the sustainment costs (shown above for the Army).

Question. What are your plans to test LEAP projectiles on SRAM and Patriot missiles: What capabilities, costs, and timeframes are involved?

Answer. Although studies are underway to determine the payoff of retrofitting Patriot missiles with the high tech LEAP projectiles, we do not envision a test program at this time.

A LEAP Advanced Technology Demonstration (ATD) plan has been proposed which exploits this high technology hardware retrofitted onto the existing SRAM system. Hardware exits today which, when combined in a fast paced ATD program, could provide a capability to demonstrate intercept of theater class ballistic missiles by 1996. These interceptors, when launched from an airborne platform cued by an airborne sensor, could intercept the missile before it reaches its apogee. Additionally, destroying the missile early in its flight might preclude the missile from dispensing canisterized munitions although it is judged technically feasible to dispense shortly after booster burnout.

A SRAM/LEAP flight test program has been prepared that would culminate in the intercept of a theater type ballistic missile in a realistic scenario by the end of 1995. This end-to-end test would demonstrate all the critical functions necessary for defense of a contested theater. Preliminary cost estimates for the SRAM/LEAP ATD indicates that $340 million through FY1996 would be required to demonstrate this capability.

BMDO is also reviewing the SRAM/LEAP proposed program in the context of its overall Boost Phase Intercept study.

ERINT MISSILE

Question. The fiscal year 1994 budget requests $98 million for the Extended Range Interceptor (ERINT). General O'Neill, describe the performance capabilities that make ERINT desirable to DOD of the TMD mission. Specifically, discuss its potential against chemical- and biological-agent warheads.

Answer. The ERINT missile is being designed to be a "hit-to-kill" weapon. The missile will be a single stage, nonseparating, composite rocket motor (lightweight) capable of accepting midcourse guidance if necessary, with active millimeter wave (35GHZ) guidance for end game. The missile is being designed to be compatible with existing and future air defense and command and control systems. The missile control system consists of impulsive thrusters that provide extremely fast response times enabling the missile to achieve the body-to-body impacts required for effective kinetic energy effects to negate stressing threats such as chemical and biological warheads.

Question. Does ERINT compete with or complement Patriot?

Answer. ERINT will complement the Patriot system if it is selected as the missile of choice to fulfill the Patriot Advanced Capability-3 (PAC-3) requirement. ERINT would be employed instead of the Raytheon-developed multimode missile (MMM).

Question. Discuss alternatives for using ERINT on Navy Aegis ships.

Answer. Representatives from the Naval Warfare Center in Dahlgren, VA, have actively participated in the ERINT program in-process reviews (IPRs) to determine the potential use of the ERINT missile on AEGIS ships. There is nothing we are currently aware of that would preclude this integration. We have undertaken a number of studies to include insensitive munitions, radar compatibility, and vertical launch system (VLS) compatibility. Again, this has all been done at the study level; nothing to date suggests this could not be done.

Question. The Committee understands that there had been a slip in the ERINT flight test program last year. Please explain why, and the implications. Is the program meeting its current schedule?

Answer. The program has encountered problems due to a number of issues. Early last year the battery supplier, Eagle Picher of Joplin, Missouri, burned to the ground with the entire run of flight test batteries inside. This caused an approximately three month delay to the program until a workaround design using existing batteries from a previous program could be incorporated into the ERINT control (no seeker) test flights. Challenges have continued to dog the on-board radar seeker development and integration, due in part to the nature of producing state-of-the-art equipment. This seeker uses some of the most advanced computers and operates at speeds that are a leap ahead of what is available today. The quantity and quality of computing power being developed for this program is necessary to accomplish the guidance accuracy needed to achieve body-to-body, hit-to-kill impacts. Barring any further major delays in the program, the FY94 budget is adequate to complete the flight test program.

Question. What is the plan for developing and testing ERINT? How much funding is involved? What are the major milestones?

Answer. ERINT will complete the remaining flight tests under contract. The next launch is scheduled for this September and tests will continue on approximately two month centers following it. If ERINT is determined to be the missile of choice for the PAC–3 requirement it will enter EMD sometime in FY 94. If it does not continue as the PAC–3 missile, we currently plan to continue the program at a level to ensure we reap all the benefits of this important technology. We are working with the Marines to determine the possibility of integrating with HAWK.

Total FY94 funding for ERINT is $97.7M. If ERINT is selected as the PAC–3 missile, the funding line within Patriot will be used for ERINT missile development.

The next year milestone will be the PAC–3 decision scheduled for this February.

Question. For the record, provide a detailed breakout for the use of FY 1994 funds for ERINT.

Answer.

PRELIMINARY ERINT FISCAL YEAR 1994 OPERATING PROGRAM

[In millions of dollars]

Effort	Performer	Program
Flt Tst Prg/Integ	LORAL	64.781
PATRIOT Integ	Raytheon/MICOM	10.000
Range Support	WSMR	5.000
SETA Support	TBE/Nichols	5.000
Internal Opr Budget	In-House	4.000
Lethality	SSDC/SLKT	3.000
Solid State & Risk Red	MAWC/China Lake	1.500
Radome Risk Reductions	Textron	1.500
Flight Test Analysis	Delta	1.000
Survivability	SSDC/SABM	1.000
Systems Evaluation	COLSA	0.490
KA-Band TWT Risk Reduction	Army Rsch Lab	0.250
Propulsion Support	Stone Eng	0.150
Total ERINT		97.671
ERINT targets		TBD

THAAD MISSILE

Question. The fiscal year 1994 budget requests a whopping $484 million to develop a new missile called THAAD (Theater High Altitude Area Defense) to be fielded after the turn of the century. General O'Neill describes the performance capabilities that make THAAD desirable to DOD for the TMD mission.

Answer. The THAAD system is being developed to provide high-altitude, broad area defense against tactical ballistic missiles. The THAAD interceptor is being designed to destroy enemy tactical missiles at a long distance from their targets through a direct "hit-to-kill" approach. This will minimize the damage that the enemy missiles would otherwise cause in the vicinity of their intended targets. The other key feature of the THAAD system is that it will be transportable on C–130 and C–141 aircraft, which will give it the capability for rapid deployment to mature or contingency theaters anywhere in the world.

Question. Does THAAD compete with or compliment Arrow and/or Patriot?

Answer. THAAD does not compete with either PATRIOT or ARROW. THAAD will constitute the upper-tier portion of a two-tier theater missile defense architecture. It provides a much wider area coverage than lower-tier systems and is designed to intercept targets at long ranges and at very high altitudes, to include intercepts outside the atmosphere. These capabilities can greatly reduce the probability of debris and chemical or biological agents from affecting the targeted area. In that sense THAAD does complement PATRIOT, which performs the lower-tier, terminal defense, functions. ARROW, which is being developed by the Israelis for their own use, is also a lower-tier system. If THAAD were deployed to Israel, it would complement ARROW in the same way as described for PATRIOT.

THAAD and Patriot PAC–3 will complement one another. The PAC–3 will serve as a lower tier and with THAAD will provide near leak proof defense of critical assets against tactical ballistic missile attacks. PAC–3 will also provide air defense protection for deployed THAAD assets.

Question. What is the plan for developing and testing THAAD? How much funding is involved? What are the major milestones?

Answer. The THAAD demonstration and validation (DEM/VAL) phase began in September 1992 with selection of Lockheed Missile and Space Company as the prime contractor. Flight tests are planned during the four-year program. The first systems are scheduled for fiscal year 1995. The option to purchase 40 missiles for user operational evaluation would allow early user assessment of THAAD's deployability and other operational considerations. The total DEM/VAL funding (FY92–97) is estimated to be $1571M.

The major milestones are shown below:

Initial Design Review	2Q93
System Flight Tests (10)	4Q95–4Q96
MS II Review	4Q96
LRIP	2Q99
MS III Review	4Q01
First Unit Equipment	4Q01

Question. When is IOC (Initial Operating Capability) planned and how is this defined?

Answer. The THAAD User Operational Evaluation System will provide a limited contingency THAAD capability by the end of 1996. The first unit equipped for the operational system is scheduled for late fiscal year 2001 (July '01). What constitutes IOC is dependent upon the final Upper Tier TMD SYSTEM design that evolves throughout Dem/Val and EMD.

Question. What are the implications of funding THAAD by Congress at the lower rate in 1994, for example at a level of $200, $300, or $400 million?

Answer. The implications for funding short falls in 1994 are as follows:

$200M—Terminate all risk mitigation efforts which significantly increases technical, schedule, and cost risk for completing the THAAD DEM/VAL program. 10–12 month slip in prime contract schedule resulting in an increase to THAAD prime contract cost of $50–75M.

$300M—Same as above except reflect a 6–8 month slip and $30–50M increase in cost.

$400M—Same as above except reflect a 3–4 month slip and $15–30M increase in cost.

Question. How much technical risk is involved in this program?

Answer. The THAAD material developer has assessed THAAD technical risks as low to medium. An aggressive risk mitigation program is in place to ensure that program risks are adequately addressed. For example, to ensure that THAAD has a high probability of target kill, flight test data against a variety of warhead configurations is required. To mitigate uncertainty prior to actual flight testing, BMDO has implemented an intensive ground test program, supported by simulation efforts, which focuses on the development of promising kill mechanisms.

Question. Characterize the degree of concurrency in this program.

Answer. The degree of concurrency in the THAAD program is minimal since the development schedule is event driven. Each major program event will be completed prior to initiation of the next event.

Question. Provide for the record a detailed description of how the fiscal year 1994 funds will be used, and an estimated total cost for this program.

Answer. The bulk of the fiscal 1994 funds will be used to prepare for the first demonstration and validation flight of the THAAD missile which is scheduled to occur during the final quarter of the fiscal year.

The FY94 program dollars are as follows:

[FY 1994 in millions of dollars]

Program Element:	
TMD Dem/Val	$484.3
Prime Contract (Lockheed and subcontractors)	[1] 391.0
Support Contractors	25.9
Other Gov't Agencies: (SSDC/MICOM), (WSMR), (MIL/LL), (MITRE)	67.0

[1] Includes $50M for potential nuclear hardening requirement.

Total THAAD acquisition costs are estimated to be $5,741M.

BRILLIANT PEBBLES

Question. Brilliant Pebbles had been envisioned as a key component of GPALS, to provide an additional layer of defense through a network of space based interceptors. The FY 1994 budget, however, requests only $72 million to continue its development. General

O'Neill, please describe Brilliant Pebbles technically and how it works.

Answer. Brilliant Pebbles consists of space, ground, and launch components. The space component is comprised of single interceptors and their associated "lifejacket" carrier vehicles. The interceptor is a lightweight, kinetic, hit-to-kill vehicle. The lifejacket provides on-orbit power, altitude control, surveillance, navigation, communications and survivability. The ground component provides "man in the loop," positive control of all on-orbit components. The launch component is used to place the space components into operational orbit. In addition, various operations and deployment modes, such as silo-based space interceptors that could be deployed in response to crises, are being explored.

The Brilliant Pebbles system works by sensing threat missiles with its surveillance sensors. Upon receipt of proper release authority, the system deploys an interceptor which guides itself to the missile, thereby effecting a kill.

Question. Explain the new Administration's acquisition strategy for Brilliant Pebbles.

Answer. The Department is no longer pursuing a Brilliant Pebbles strategy of acquiring a system as part of the BMDO initial BMD architecture. It is no longer scheduled to meet a Milestone II in FY 1996. FY 94 funding has been reduced from the $362M that was in the revised FY 94 Bush Administration budget to $72.7M that is in the current administration's budget.

BP is an Advanced Technology Demonstration (ATD) program with a focus on expanding the technology base for kinetic energy weapons systems and answering the associated critical technical and operational issues. The program is in the Other Follow-on BMDO budget line and is competing with other kinds of technologies (for example, directed energy) for potential future funding and further system development.

Question. What value is there to doing this program at all at such a slow pace: is it needed or not?

Answer. The FY 94 funding level maintains technologies needed to field a space-based kinetic energy system, preserving the option for decision makers to acquire a system should it be required at a later time. In addition, the current funding level preserves progress made to-date, and allows flight test hardware/software that has already been developed to be tested. Note that these test operations are expensive, and can not be conducted with less than current funding levels.

Question. Under this strategy, when is the earliest that Brilliant Pebbles could be fielded?

Answer. Brilliant Pebbles could field pre-production development prototypes about 4–5 years after a decision to proceed. This would entail more extensive testing and the onset of low-rate initial production. This would require significant increases in the funding currently allocated to the program.

Question. What are the ABM Treaty implications for Brilliant Pebbles?

Answer. The U.S. has begun a comprehensive examination of U.S. ballistic missile defense policy and objectives and related ABM Treaty issues. This review, which should be completed in the near future, will provide the basis for U.S. decisions on our options for ballistic missile defenses, including the need for modification of the ABM Treaty, if any. At the completion of the study, we will be able to provide a more complete description of the ABM Treaty implications for Brilliant Pebbles.

Question. Discuss the option to deploy a ground-launched, silo-based Brilliant Pebbles system. What are the cost implications? What boosters would be used to launch them? What potential locations could be involved? How much is budgeted in 1994 to study it?

Answer. As an Advanced Technology Demonstration (ATD) program, minimal work is being done on developing BP deployment concepts. The focus of the program is to research kinetic energy interceptors and concepts. Analyses are being conducted to investigate innovative ways to deploy the baseline BP interceptor by Martin Marietta and TRW/Hughes. In these trades, the program reviewed BP-derivative interceptors launched from ships; aircraft like the F–15, B–1 or B–52; space; and from both mobile and fixed land-based silos. Also reviewed were launch vehicles such as the MX, Castor, Pegasus, Atlas, Titan, Taurus, Minuteman and Poseidon. A variety of launch locations were studied on each coast and in the midwest.

Preliminary results show that BP is a highly versatile interceptor technology program. Many potential deployment paths are possible and technically feasible, if there were some decision to want to flesh out a more robust system. The cost of such a system would be wholly dependent upon the number of interceptors you choose to field. For example, a land-based system, not omnipresent in space, but launched from silos and tailored to meet specific threats (with about 308 BPs and all the associated launch and deployment costs) could cost less than $8B in FY 1988 dollars. Such a system could provide multi-theater protection against a variety of threats. There are no dedicated funds associated with development of those alternatives.

Question. Provide for the record a detailed description of how the fiscal year 1994 funds will be used, and an estimated total cost for this program.

Answer. The FY 94 funding will be used as follows:

[In millions of dollars]

Prime Contractors	$60.5
GFE	7.7
Program Office Overhead	4.5
Total	72.7

The total program cost will depend on future decisions about the program.

[CLERK'S NOTE.—End of questions submitted for the record.]

TUESDAY, MAY 4, 1993.

DEFENSE REINVESTMENT AND CONVERSION PROGRAMS

WITNESS

HON. JOHN M. DEUTCH, UNDER SECRETARY OF DEFENSE FOR ACQUISITION

INTRODUCTION

Mr. DICKS. The Committee will come to order. Today's hearing will be on defense conversion. The principal witness is Mr. John M. Deutch, Under Secretary of Defense for Acquisition.

Mr. Secretary, welcome to the Committee. We will place your statement in the record and you may proceed in any way that you wish. We are pleased to have you here.

SUMMARY STATEMENT OF MR. DEUTCH

Mr. DEUTCH. Thank you, Mr. Chairman. Let me summarize the principal points in my testimony and take any questions that you may have, Mr. Chairman. There is considerable interest in the subject of defense conversion. I believe that that interest is based on a common importance that we all want to see the resources, people, facilities and dollars that were previously devoted to defense turned to productive use in our economy.

In the short run, the downturn in defense spending adversely affects workers, adversely affects communities and threatens the vitality of our technology efforts. The defense reinvestment programs of Secretary Aspin and President Clinton are placing a great deal of emphasis here and are intended to address these issues and look towards strengthening the economic health of our country.

The programs consist of three different parts. First is assistance to affected individuals. The second is assistance to impacted communities, and the third is investment in dual-use technologies that contribute to our defense needs and to high quality jobs in the civilian commercial sector of our economy.

The fiscal year 1994 budget submitted to you, Mr. Chairman, contains $555 million for personnel assistance programs; $138 million for community adjustment programs; and total defense technology investments over $1.4 billion.

We at the Department of Defense, Secretary Aspin, Deputy Secretary of Defense Perry and myself, are vitally interested in this program and are personally committed to its success.

Deputy Secretary Perry has asked me to watch over all parts of the defense reinvestment programs, which I am doing; and I believe we have a strong and vigorous program in the budget which has been proposed to you. I am working with other agencies of government, national and economic councils, and the White House to make sure that these programs are integrated with the efforts of other agencies.

In my judgment, these are important programs to assure that the economic security of our country remains as strong as the national securities must be.

Thank you for your attention, Mr. Chairman.

I will be happy to take any questions that you may have.

[The statement of Mr. Deutch follows:]

Statement of
John M. Deutch
Undersecretary of Defense (Acquisition)

on

Defense Reinvestment and Conversion Programs

Before the
House Appropriations Committee
Defense Subcommittee

May 4, 1993

Not for publication
until released by
the Committee

Mr. Chairman and distinguished members of the Subcommittee, I am pleased to appear before you today to discuss the Department of Defense's programs and plans for defense reinvestment and conversion.

Last year, the Congress passed the Defense Conversion, Reinvestment, and Transition Assistance Act of 1992. We are aggressively implementing this legislation, which laid the foundation for the Administration's defense conversion programs. For example, we have already released $225.5 million in DoD funds to support the defense transition programs of the Departments of Labor, Commerce, and Veterans Affairs, as required by the law. I look forward to working closely with you to build upon our current efforts.

The collapse of the Soviet Union and the dissolution of the Warsaw Pact have made possible sweeping changes in our national defense policies and priorities. As Secretary of Defense Aspin has noted, the United States still faces threats to national security, including regional threats to U.S. interests, the proliferation of weapons of mass destruction, the possible failure of democratic reforms, especially in the former Soviet Union, and continued poor economic performance at home. While these threats are important, meeting them will require lower levels of defense spending than was necessary during the Cold War era.

Lower levels of defense spending will benefit the nation as a whole. Wise reinvestment of defense resources will lead to higher levels of economic growth in the long run. Spending less on defense also means that resources we have been devoting to preserving national security can be reallocated to other productive purposes in the public and the private sector.

In the short run, however, shifting resources from defense will create economic dislocations. Thousands of military personnel, Department of Defense civilian employees, and defense industry workers will have to find new employment. Communities with closing or shrinking defense installations or defense contractors will have to attract new sources of economic livelihood. Defense companies will have to find new markets, shrink to match a smaller defense market, or merge with other firms to remain competitive. The effects of these dislocations are evident today.

Because of the necessity of reducing defense spending, and because we recognize the difficulties that often accompany these reductions, the Department of Defense is implementing numerous programs to speed and ease the transition of affected people and communities, and to strengthen the industrial and technology base.

Before I discuss our defense reinvestment and conversion programs, I would like to highlight the philosophy that guides our approach.

PRESIDENT CLINTON'S DEFENSE REINVESTMENT AND CONVERSION PROGRAMS

On March 11 in Baltimore, President Clinton announced the Administration's defense reinvestment and conversion programs. In his speech, the President noted that defense conversion will not be easy, but the alternatives--to cut defense without an effective defense conversion program, or one that is too localized or too limited--are unacceptable.

In addition to smoothing the transition for people, communities, and the industrial and technology base, each of the Department's defense conversion and reinvestment programs also meet well-established DoD missions, such as maintaining a ready, high-quality fighting force at the right size, aiding communities affected by base closures and other reductions, and developing technologies for defense.

Each program was also created to meet five key criteria. The programs seek to:

- generate economic growth and create new jobs,
- achieve measurable, concrete results at reasonable costs,
- depend on market forces to the maximum extent practicable,
- leverage additional resources, such as matching funds, and
- take advantage of existing organizations and programs to minimize the creation of new bureaucracies.

To be fully successful, defense conversion efforts must be accompanied by effective reform of the acquisition system. Some of the programs represent concrete steps DoD can take to increase efforts to develop dual-use technologies and to foster the integration of defense and commercial manufacturing and business practices, two of the Department's long term goals for acquisition reform. Pursuing dual-use technologies and commercial-military integration will allow the Department faster and lower-cost access to technologies for advanced weapons, encourage faster and lower-cost manufacturing, create a much larger industrial base to draw upon, and facilitate defense conversion efforts.

In creating and implementing our programs, the Department is working closely with the many other Departments and agencies that have important defense reinvestment and conversion programs. This close cooperation has allowed the Administration to coordinate programs, capitalize on strengths throughout the government, and limit wasteful duplication. DoD participates in inter-agency working groups on defense conversion and related issues chaired by the White House National Economic Council. Outside of these working groups, DoD is working closely with the Departments of Commerce, Labor, Veterans Affairs, and Energy, the National Aeronautics and Space Administration, the National Science Foundation, state employment agencies, and others. We plan to continue these successful efforts.

DoD's REINVESTMENT AND CONVERSION PROGRAMS

I would like to briefly describe the programs for 1993 and 1994 that the Department is pursuing for people, communities, and the technology and industrial base. DoD funding for Presidential defense reinvestment and conversion initiatives is $1.44 billion for 1993. DoD's 1994 budget includes $1.66 billion of new initiatives for 1994. Based on an accounting that includes ongoing programs, DoD total funding for these programs is $2.5 billion in 1993 and $2.3 billion in 1994. The President's 1994 budget increases Administration-wide funding for defense reinvestment and conversion initiatives to $3.3 billion, almost double the 1993 level of $1.7 billion.

People

We are implementing numerous programs to help people affected by the drawdown. We are trying to minimize involuntary reductions in force (RIFs) in the Department by offering retirement and resignation incentives to selected civilian personnel and retirement benefits to selected military personnel with between 15 and 19 years of service. We are also continuing the highly successful Voluntary Separation Incentive and Special Separation Benefit programs to encourage voluntary separations of career military personnel.

The Department has also increased its efforts to provide retraining and other employment services. We released $75 million to the Department of Labor to provide retraining and employment services to separating military personnel, DoD civilian employees, and private sector defense workers. We also released $70.5 million to the Department of Veterans Affairs to implement the Service Members Occupational Conversion and Training Act, which will provide training to veterans. In addition, we are implementing transition assistance programs for members of the National Guard and Reserve and are working closely with state employment agencies, the Department of

Labor, and the Department of Veterans Affairs to provide employment information to separating personnel.

The President's fiscal year 1994 budget includes $555 million for personnel assistance programs, compared with funding of $409 million in for the 1993 fiscal year.

Communities

For over 30 years, DoD has worked with communities to ease the effects of changes in defense spending. During the drawdown, this mission takes on increasing importance. Many communities will lose key sources of economic strength through reductions and closures of bases and defense plants. The Department plans to increase significantly its community adjustment and revitalization efforts.

For 1993, DoD has tripled the budget of its Office of Economic Adjustment (OEA), which works closely with other federal, state and local government agencies to assist communities. OEA funding for 1993 is about $30 million. The Department has also released $80 million to the Economic Development Administration of the Department of Commerce to support business development, public works, technical assistance, or almost any other activity identified in each community's adjustment plan.

DoD is also increasing its community assistance efforts in three important ways. First, the Department is developing programs to place qualified separating defense personnel in community and public service jobs. Second, we are implementing and expanding community service programs such as the National Guard Civilian Youth Opportunities Pilot Program and those that help meet critical needs in the nation's high schools. Third, we are making a concerted effort to speed-up the environmental restoration process at closing facilities. By doing so, we will ensure that environmental clean-up does not become a barrier to communities' rapid reuse of closing installations. A new position of Deputy Undersecretary of Defense for the environment has been created to place increased emphasis on environmental issues.

DoD's 1994 budget includes $138 million for community adjustment and assistance programs. DoD funding for community programs in 1994 is lower than it was in 1993 because some 1994 program responsibilities will be funded directly through the Department of Commerce, rather than through DoD as was done in 1993, and because the 1994 budget does not include some one-time programs for 1993.

The Technology and Industrial Base

The Defense Conversion, Reinvestment, and Transition Assistance Act of 1992 created a number of new programs for the technology and industrial base that the Department is implementing aggressively.

The Administration recently established the Defense Technology Conversion Council (DTCC), which includes DoD's Advanced Research Projects Agency, the Department of Energy, the Department of Commerce, the National Science Foundation, and the National Aeronautics and Space Administration. The DTCC created and is carrying out the Technology Reinvestment Project (TRP). TRP programs are designed to stimulate the transition to an integrated, national industrial capability that provides advanced military systems and competitive commercial products. These programs will develop dual-use technologies, provide manufacturing and technology assistance to small businesses, enhance U.S. manufacturing skills, and assist displaced defense industry workers.

The TRP is revolutionary program in many respects. The TRP is unique because it:

- results from unprecedented cooperation among Federal departments and agencies,
- ensures that industry is actively involved in shaping the program,
- addresses the broad spectrum of essential technology and industrial base programs, from technology development to deployment to manufacturing education, and
- recognizes the diversity of the defense industrial base by focusing specific programs on the needs of small defense businesses.

In March 1993, the DTCC published a Program Information Package that clearly explains TRP programs. In recent weeks, the DTCC traveled to New York, Detroit, Orlando, Dallas, Los Angeles, St. Louis, Boston, Albuquerque, and Hartford to present information conferences for prospective participants in TRP programs. These conferences were successful by any measure and were well attended: over 5,000 people participated. More conferences are planned for the coming weeks in Denver, New Hampshire, Oakland, Philadelphia, and Seattle. The DTCC plans to release a formal solicitation on May 14th. The planned deadline for proposal submissions is July 23, 1993, with awards planned before September 30, 1993.

Including ongoing efforts, technology and industrial base reinvestment and conversion programs total $1.8 billion in 1993 and $1.6 billion in 1994.

CONCLUSION

I have concentrated on DoD's programs. But other Departments and agencies also have important defense reinvestment and conversion programs. We look forward to continuing to work closely with other federal, state, and local government organizations to develop and implement effective defense transition programs.

Let me conclude by emphasizing two points. First, it should be clear that effective defense reinvestment and conversion programs meet the needs of our national defense and of our national economy. When we ease the transition of people, we speed their reentry into the labor force. When we help communities adjust to reduced defense spending, we help spur economic growth. When we pursue dual-use technologies and commercial-military integration, we allow DoD to purchase better products at lower cost and help the economy.

Second, I would like to stress the importance of your support for President's 1994 budget for defense reinvestment and conversion programs. As you know, the previous Administration did not implement most provisions of the Defense Conversion, Reinvestment, and Transition Assistance Act of 1992. The Clinton Administration came into office deeply committed to implementing the Act, but well into the 1993 fiscal year. Although we had a late start in 1993, we are implementing the Act as quickly as we can, consistent with the dictates of sound management. We will need all of the resources you provided for 1993, as well as those requested for 1994.

Thank you for the opportunity to discuss our defense reinvestment and conversion programs with you today. I look forward to answering any questions you might have.

CONVERSION PHILOSOPHY

Mr. DICKS. Mr. Deutch, you have had a long, distinguished career. You have served in the government before as Under Secretary for the Department of Energy.

I must say that I have some reservations about the notion of defense conversion. I think it can be a valid concept and I think it can produce real results, but I do urge the administration to really look at this carefully since we operate in a free enterprise, market-oriented economy.

The Soviet Union, on the other hand, and now the republics, the former republics of the Soviet Union, are trying to convert a series of state-run enterprises into a market economy; and one of the harsh realities of our economic system is that when the money for a certain sector, the government, the Pentagon in this case, goes down, there is going to be an adjustment.

I am concerned about the people. There are indications that up to two million people are going to lose their jobs and the thousands of service members are leaving the armed forces. The Army is one of the greatest ways of advancing the principles of this society and helping minorities progress. My question is, can we make this a real program that is relevant to people, to communities, and can we make it something that will provide new economic opportunities other than just a program to soothe the conscience of those who are involved in a very dramatic reduction in defense spending, which is going to cause serious economic dislocations in this country.

I think we must spend this money as wisely as we can, but there is a kind of symbolism that has surrounded defense conversion that is more troublesome to me. Maybe we ought to come up with a different phrase, that we are reinvesting in people or for the first time have an industrial policy in America where we use dual use technologies in other areas and we are going to try to help communities.

I think the community aspect of this is very real. When there is a major base shutdown or we lose a major defense contractor because of budgets coming down, the consequences to the community and to individuals are real. But the idea of somehow magically we can convert a plant into the free enterprise economy will not work without a real product, and demand for the product. I think there has to be a sense of reality to all this.

I say that because I am for it, I voted for these funds, I am going to support you on this; but I want you to be as realistic about this as you can be, to make sure the money is spent on things we will be proud of in three or four years.

Mr. DEUTCH. Mr. Chairman, I am in perfect sympathy with everything you said. I try to refer to this program as a defense reinvestment program. We all do in the economic growth initiatives of this administration. We try to refer it to as defense reinvestment for the reasons that you mention.

I am pleased to see that you didn't refer to a lot of investments made when I was in the Department of Energy and how they worked out. I appreciate that.

I want to make two remarks about the program. The big dollars are on the technology side and with dual-use technology. Here we have an identifiable commonality of interest between defense and the civilian applications and underlying technology; whether microelectronics, agile manufacturing, advanced materials, high performance computing, these are basic technologies which can serve both the defense and commercial sectors. In this regard, I think it is a win-win situation. Those are the kinds of investments we are looking for. That is where the big dollars are.

In community assistance and personnel areas, it is important to soften the decline in the defense turndown, but they cannot have the long-term job creation the others have. I pledge that Bill Perry and I are looking for investments which have the greatest possible long-term growth.

SEMATECH PROGRAM

Mr. DICKS. We have been very active in support of SEMATECH. One thing that I think is good about SEMATECH is that the private sector is willing to put up some of their own money. The consortium and the private sector put up $100 million on each side. That is a bit of a market test. People aren't going to put up $100 million if they don't think they are going to get something out of this.

As we look at dual-use technologies, as we try to build a better automobile which is more energy efficient, or reach out with high-speed computers, advanced software, and ceramics, et cetera, you have to have the private sector willing to put up its money to be a partner in this.

I know there are anti-trust issues and difficulties surrounding how you put these things together. Do you think that is another valid way of gauging whether there is real support in the marketplace for these kinds of dual use investments?

Mr. DEUTCH. I do. Most of the funds provided by Congress for fiscal year 1993 do have cost-sharing requirements. There may be instances for small business where those become somewhat of a burden, but in general there is nothing like the willingness of the private sector to come in and cost-share if it is a serious proposal. In addition, I think it is very important in these programs that they get carried out with the planning and participation of private companies who know the commercial sector.

Mr. DICKS. Mr. Livingston.

Mr. LIVINGSTON. Thank you, Mr. Chairman. In Investors Business Daily there was an article that was somewhat critical of the SEMATECH performance. There was an evaluation evidently that determined that whatever government participation there was was sufficient to take the incentives of the private sector away from the decision-making process and to distract the fine energies that are concentrated in a laissez-faire economy to the point that they settled on a product to be developed that perhaps is less popular than was first anticipated.

I think SEMATECH has been prominent in high-definition TV, and evidently that is not going the way they had wanted. I may be wrong on my scientific analysis, but I am certain about the article.

The final and bottom line of the article was that when government gets involved in the private sector and starts making decisions towards developing certain products, they often turn out to be the wrong products.

They used Intel and various other private sector companies who had developed the microchips without government assistance as being indicative of where the private sector does best; it picks and chooses the right products, and because the profit motive is the only reason for doing business, that they have a chance of being far more successful than do organized government projects.

Mr. DICKS. Why don't we ask the Secretary to comment on that?

Mr. DEUTCH. I guess the distinguishing feature here is the dual-use aspect of these technology investments. I am the last to pretend that the government is better able to judge where the private marketplace is going than the private sector itself. But we have a unique circumstance here of basic technologies which contribute both to national defense and to, potentially, the commercial sector.

I think it is legitimate to look at those projects on a case-by-case basis, on a technology-by-technology basis. I don't think we will always be successful, but I don't think there is any effort to start a command economy and get involved in the private sector. We all know the failings of that, and I am with you on that.

COMMERCIAL AVIATION

Mr. DICKS. There is no doubt that a lot of what happened in defense aviation had a profound impact on the development of the whole commercial sector. If SEMATECH isn't the best example, I would point to that one as one that we could not quarrel with, where the government—because of its investment in defense, there was a conversion to civil aviation, the jet engine, things of that nature, all of which made America the premier producer of jet aircraft with one of our best exports.

INDUSTRIAL POLICY

It just seems to me that we would be very naive if we don't recognize that the European Community and the Japanese are involved in a very sophisticated industrial policy, where there is cooperation between their private sector and their governments. I think one of the issues in this campaign was whether the United States in fact was going to have an industrial policy. It seems to me that an aggressive dual-use technology program is good policy, and something that we ought to at least experiment with and see how it works.

Mr. LIVINGSTON. Would you yield further?

Mr. DICKS. You are next to ask questions.

Mr. LIVINGSTON. I don't know that I have many questions.

Once you make the decision to venture into the tent, as we have always heard about the camel, and the question is whether or not the whole camel gets into the tent, now we are hearing stories about the German and Japanese economies both trailing off because government has become too involved, the distribution system of the Japanese economy is appalling, products are extraordinarily more expensive for the Japanese people than they are in this country, and the Germans can't find ways to put more people to work. So a lot of those problems can be drawn directly——

Mr. DICKS. Part of the problem there, I think, is East Germany.

Mr. LIVINGSTON. Certainly, but the West Germans, I don't think have created any new jobs in the last 12 years. They are desperately trying to maintain their current situation and they are having difficulty doing it. A lot of it is government intervention. Certainly I think you can make a very strong case that our government could be more involved and could indeed assist the private sector to become more profitable.

On the other hand, maybe our tax policies could be less restrictive and the private sector could then make their own decisions on where they could be profitable; and we don't have to convey our wisdom and control the economy from here in Washington.

CONVERSION PROGRAMS

Mr. DICKS. I have one question. Please explain DOD's plans for regional technology alliances, government industry partnerships, development of advanced materials manufacturing and other dual-use technologies, and States and local manufacturing extension programs.

Mr. DEUTCH. These are all different parts of the programs that were enacted in fiscal year 1993. All of the ones that you mention will be under, I believe, ARPA; and we are in the process of executing those programs in collaboration with the Department of Commerce, the National Science Foundation, as recently announced as the Defense Reinvestment Initiative.

One of them I would mention on the list is the Extension Service where I believe $200 million of manufacturing Extension Service was appropriated in fiscal year 1993, and we have $25 million in fiscal year 1994. We are discussing with the Department of Commerce whether this is a responsibility which is better executed by them.

But the list of projects that you mentioned is being implemented now. ARPA is going throughout the country—you will hear from Mr. Denman in a little while about these projects and their cost share.

Mr. DICKS. Mr. Livingston? Mr. Visclosky.

CONVERSION PHILOSOPHY

Mr. VISCLOSKY. Thank you, Mr. Chairman. Doctor, when you talk about defense conversion what do you mean?

Mr. DEUTCH. I speak in terms of defense reinvestment. There are three aspects of these programs: to help individuals whether they are military, civilian government employees, or those who work in the defense industry adjust to the downturn which is occurring in the defense sector; assistance to communities which are adversely impacted by the defense downturn; and third, the dual-use technology efforts where we try to invest in certain technologies that have a payoff for the commercial sector of our economy and for the defense sector.

Mr. VISCLOSKY. In terms of the conversion program, how long do you think it will last?

Mr. Deutch. I believe it is a multiyear effort which will, in my judgment, require at least the dual-use technology. I think it will be with us as part of our underlying R&D efforts. The impact assistance for communities and for personnel will depend upon how long it takes to get to a stabilized defense budget and how long it takes the economy to adjust to those dislocations that have occurred as a result of the sharp downturn.

Mr. Visclosky. I asked what conversion means to you. I represent the First District in Indiana, northwest corner of the State, and since 1977 we have lost over 38,800 jobs. We are still losing a hundred jobs a month at Inland Steel.

There was a lot of talk on behalf of several administrations that we are going to convert the skills and the people involved, we were going to assist the communities involved; and my district is an economic wasteland in whole areas. Only 13 districts out of 435 lost more people, because the general attitude has been, let them move to find a new job.

My attitude on America is, you should move to improve your circumstances in life, not because it is forced upon you because there is no hope in your community.

The administration asked for $4 billion in the next four years for individual assistance. I must tell you, my prejudice of all the programs I have seen is, at best, they amount to preparing resumes, helping send them out, providing telephone directories for cities in other parts of the country unrelated to the Midwest. I think they have been a failure.

ASSISTANCE TO INDIVIDUALS

In terms of assistance to individuals, what is the Department's plan? I want to make my position clear, I don't want the government to do to military personnel or civilians or those communities involved what was done to the people I represent. That should never happen again.

Mr. Deutch. I understand. For my home state of Massachusetts, I have seen a lot of impacted communities. I know how difficult it can be for people and for the communities from which they come. The DOD is trying to mount some programs, and I admit they are partial, and often seem inadequate to the individual who is affected, to help people find jobs.

We are working with the Economic Development Administration (EDA) in the Department of Commerce, and the Department of Labor to mount more effective programs. It is a difficult circumstance, no question. I do not have, nor do I propose, some comprehensive solution within DOD. We have tried a number of things: job banks, helping people find employment elsewhere, and assisting communities in terms of planning. That is the best we have been able to do.

We will continue to put our best efforts on that because we recognize the public support for Defense will depend upon how well we handle the impacts on people and communities which come from this downturn.

Mr. Visclosky. How do you target which individuals will be assisted?

Mr. **Deutch**. There are a variety of programs, some of which are in place, and some of which are being created now such as our participation in the national service initiative of President Clinton.

I will get you answers for the record about how individual communities or individuals within communities are selected.

[The information follows:]

A summary of programs and benefits supporting the drawdown follows. Personnel eligible for assistance are indicated next to each program or benefit.

SUMMARY OF PROGRAMS AND BENEFITS SUPPORTING THE DRAWDOWN

The drawdown affects three categories of people: (1) military personnel and their dependents, (2) DoD civilian employees, and (3) defense contractor employees and individuals in civilian communities (i.e. the private sector). The following is a summary of the various programs and benefits available through DoD and other federal agencies to assist these people. These assistance programs generally fall into one of five categories: employment assistance, financial assistance, separation assistance, education or retraining assistance, and community economic adjustment assistance. Personnel eligible for assistance are indicated next to each program or benefit.

MILITARY PERSONNEL AND DEPENDENTS

EMPLOYMENT ASSISTANCE

-- Transition Assistance Program (TAP): A three-day seminar offered by VA, DoL and State Employment offices at most major military bases in the U.S. The workshop addresses job counseling, interviewing skills, resume preparation, skills assessment, relocation information and veterans benefits. (All military personnel and spouses)

-- Defense Outplacement Referral Service (DORS): A computer automated system which offers employers access to mini-resumes of separating Service members and their spouses through a 1-900 number. (All military personnel and spouses)

-- Transition Bulletin Board (TBB): A computer automated bulletin board available at over 350 military bases where employers at no cost can post job-openings for interested Service members and their spouses. (All military personnel and spouses)

-- Veteran Job Fairs: Provide a forum for prospective employers and separating Service members to meet face-to-face. Sponsored by DoD, OPM, DoL, and VA. (All military personnel and spouses)

-- Verification of Military Experience and Training: Provides Service members with a document which summarizes their military training and experience and translates this experience into equivalent civilian sector occupational experience and recommended college credits. This assists Service members in writing resumes, verifying experience to employers, and negotiating for credits in educational or training institutions. (All military personnel)

-- Hiring Preference in Non-Appropriated Fund (NAF) Jobs: Eligible military separatees and their family members receive a one-time hiring preference for the 200,000 NAF jobs potentially available. NAF jobs are jobs in self-sustaining commercial enterprises (e.g. commissaries and post exchanges) which support morale and welfare on military installations. (All eligible involuntary separatees and dependents and VSI/SSB participants and dependents)

- -- Priority in Affiliating with Guard and Reserves: DoD grants priority placement to certain eligible military separatees on applications to the National Guard or Reserves within one year after separation. (Certain eligible involuntary separatees and VSI/SSB participants)

FINANCIAL ASSISTANCE

- -- Unemployment compensation: Separated military personnel are eligible for benefits based on individual state laws that determine the amount of compensation and the number of weeks payable. (All eligible military separatees)
- -- Separation Pay: Provides a lump sum payment to involuntarily separated officers and enlisted personnel upon separation equal to 10% of the member's final monthly basic pay multiplied by 12 and multiplied again by the member's years of active service. (All eligible involuntary separatees)
- -- Voluntary Separation Incentive (VSI): Provides an annuity payment equal to 2.5% of the voluntarily separating member's final basic pay multiplied by 12 and multiplied again by the member's years of active service. The annuity is received for 2 x the number of years of active service. (Eligible voluntary separatees)
- -- Special Separation Benefit (SSB): Provides a single lump sum payment upon separation equal to 15% of the voluntarily separating member's final monthly basic pay multiplied by 12 and multiplied again by the member's years of active service. (Certain eligible voluntary separatees)
- -- Temporary Early Retirement Authority (TERA): Permits the early retirement of selected members. An individual approved under TERA is entitled to all of the normal retirement benefits of a person retiring with twenty or more years. The only difference is that the retirement pay rate is reduced by a factor of 1 percent for each year of service less than 20 years. This means that while a 20-year retiree receives 50 percent of base (2.5 percent a year x 20 years), a 15-year retiree receives 35.6225 percent (2.5 percent x 15 years x.95 percent reduction factor). (Selected members with more than 15 but less than 20 years of service)

SEPARATION ASSISTANCE

- -- Preseparation and Relocation Counseling: Separating military personnel and their spouses receive counseling on ten areas concerning available educational, health, and job-placement/job-search benefits and the development of an individual transition plan. (All military personnel)

- -- Health Benefits: 120 days of extended medical benefits through CHAMPUS or a military treatment facility and an opportunity to purchase private health insurance for up to 18 months with additional coverage for certain preexisting conditions through DoD (60 days of health care for members involuntarily separated with less than 6 years active duty service). (All eligible involuntary separatees, VSI/SSB participants, and certain eligible voluntary separatees)
- -- Leave: Up to 30 days time off without pay, or up to 20 days time off with pay to look for a new job and house (up to 30 days time off with pay if member is stationed outside the CONUS). (All eligible involuntary separatees, VSI/SSB participants, and certain eligible voluntary separatees)
- -- DoD Military Family Housing Extension: 180 days extension at reasonable rental rate. (All eligible involuntary separatees and VSI/SSB participants)
- -- DoD School Extension: Allows completion of final year of high school for students overseas in DoD schools. (All eligible involuntary separatees and certain eligible voluntary separatees)
- -- Extended Commissary/Exchange Privileges: Extended for 2 years after separation. (All eligible involuntary separatees and VSI/SSB participants)
- -- Homeowners Assistance Program (HAP): DoD will purchase the home of military members in base closure communities or where significant DoD reductions have adversely impacted home values. (Certain military personnel in affected communities)

EDUCATION/RETRAINING ASSISTANCE

- -- Montgomery G.I. Bill: Eligible separating personnel (including VSI/SSB recipients, retroactive to December 15, 1991) have an additional opportunity to enroll in the G.I. Bill program to receive financial assistance for educational expenses. Current total benefits amount to $14,400 for those serving on active duty for three years or more, or $11,700 for those serving two years. Enrollees contribute $100 per month for 12 months or pay $1200. (All eligible involuntary separatees)
- -- Job Training Partnership Act (JTPA) Assistance: Federal funds are available through the states by local private industry council programs to provide retraining and job placement assistance for employees scheduled to lose their jobs or who have already been separated. (All eligible involuntary separatees and certain eligible voluntary separatees)

DOD CIVILIAN EMPLOYEES

EMPLOYMENT ASSISTANCE

-- Transition Assistance Program (TAP): A three-day seminar offered by VA, DoL and State Employment offices at most major military bases in the U.S. The workshop addresses job counseling, interviewing skills, resume preparation, skills assessment, relocation information and veterans benefits, if appropriate. (All DoD civilians and spouses)

-- Defense Outplacement Referral Service (DORS): An automated system which offers employers telephonic access to mini-resumes of DoD civilian employees and their spouses. (All DoD civilians and spouses)

-- Transition Bulletin Board (TBB): An electronic bulletin board available at over 350 military bases where employers at no cost can post job-openings for interested DoD civilian employees and their spouses. (All DoD civilians and spouses)

-- Priority Placement Program (PPP): An automated system that requires DoD agencies to hire civilians adversely affected by drawdown initiatives into DoD vacancies for which they qualify. (All involuntary DoD civilian separatees)

-- Relocation Assistance: Employees are reimbursed for moving costs and associated real estate expenses when placement in DoD as a result of drawdown initiatives requires relocation. (All involuntary DoD civilian separatees)

-- OPM Interagency Placement Assistance Program (IPAP): Provides early placement in Federal agencies for employees before they receive a reduction in force notice. (All DoD civilians)

-- OPM Displaced Employee Program: Provides placement assistance to separated employees for jobs in Federal agencies. (All involuntary Federal separatees)

-- Access to OPM Government-wide Vacancy List: Federal agencies must report vacancies for which they are accepting applications to the Office of Personnel Management. OPM will publish a list of all such vacancies. In addition, displaced DoD employees are assured of "full consideration" for vacancies for which they apply. (This list will be available to the general public.)

-- Outplacement Subsidy: In coordination with GSA, DoD has established a program to encourage attrition to other Federal agencies. We will, in many cases, agree to pay relocation costs up to a maximum of $20,000 if the employee takes a job with another Federal agency in a different location. (employees in surplus categories)

--"Right of First Refusal" for Contractor Jobs: Where private contractors are hired to close an installation, Federal employees have right of first refusal for jobs for which they qualify. (DoD civilians at closing installations)

FINANCIAL ASSISTANCE

- Severance Pay: Paid to involuntarily separated employees at the rate of one week of basic pay for each year of creditable service up to 10 years, plus two weeks of pay for each year of service beyond 10 years, plus 10% of the total severance pay for each year over age 40. (All DoD civilians)
- Civilian Separation Pay: Lump sum incentive up to $25,000 to encourage and minimize involuntary separations. (DoD civilian employees in targeted occupations, grades, and locations)
- Early Retirement: An immediate annuity is available to those employees in organizations undergoing major reductions if they have 20 years of service and are age 50, or have 25 years of service at any age. (All involuntary DoD civilian separatees and certain voluntary DoD civilian separatees)
- Lump Sum Annuity Payment: Any retirement eligible (including early retirement) employee whose job is abolished may elect the alternative form of annuity (AFA) which equals their lifetime contributions to the Civil Service Retirement Fund (usually about $30,000). (All involuntary DoD civilian separatees)
- Unemployment Compensation: Separated employees are eligible for benefits based on individual state laws that determine amount of benefit and number of weeks payable. (Certain involuntary DoD civilian separatees)
- Supportive Services: The Labor Department, through local grantees, may pay for childcare, commuting assistance, and financial counseling in connection with the Job training Partnership Act.
- Needs-Related Payments: The Labor Department, through local grantees, may provide such payments to those who do not qualify or have ceased to qualify for unemployment compensation in connection with the Job Training Partnership Act.

SEPARATION ASSISTANCE

- Preseparation Counseling: Counseling is offered at local installations to include financial counseling and stress management. (All DoD civilians)
- Annual Leave Refund: Unused annual leave is paid in a lump sum upon separation. Employees at closing installations may carry over more than the usual 240 hours of annual leave into a new leave year. (All DoD civilians)
- Health Insurance: Coverage continues for 18 months after separation. DoD pays a portion of the premium for DoD involuntary civilian separatees. (All Federal employees)

- Life Insurance: Coverage continues for 31 days after separation to allow conversion to an individual policy without taking a physical exam. (All involuntary DoD civilian separatees)
- Homeowners Assistance Program: DoD will purchase the home of civilian employees in base closure communities or where significant DoD reductions have adversely impacted home values. (Certain DoD civilians in affected communities)

EDUCATION AND RETRAINING ASSISTANCE

- Job Training Partnership Act (JTPA) Assistance: The Labor Department, through local grantees, may pay for job testing, counseling, search, placement, or retraining up to 2 years before base closure or realignment or 6 months before expectation separation. (All DoD civilian separatees)
- Skill Training: Provides up to one year of entry level retraining in military skill training programs that are transferrable to private sector. (DoD civilian employees who are involuntarily separated)

DEFENSE CONTRACTOR EMPLOYEES AND CIVILIAN COMMUNITIES (PRIVATE SECTOR)

EMPLOYMENT/EDUCATION/RETRAINING ASSISTANCE

- Job Training Partnership Act (JTPA) Assistance: Federal funds are available through the states by local private industry council programs to provide retraining and job placement assistance for employees scheduled to lose their jobs or who have already been separated.

FINANCIAL ASSISTANCE

- Unemployment compensation: Separated employees are eligible for benefits based on individual state laws that determine amount of benefit and number of weeks payable.

COMMUNITY ECONOMIC ADJUSTMENT ASSISTANCE

- DoD Economic Planning Assistance: DoD provides overall technical guidance for 3 to 5 years to local adjustment organizations. DoD also provides economic adjustment strategy and military base redevelopment planning grants (FY 1993 budget, $25 million) to qualifying communities. Since 1989, planning grants have been provided to 48 communities experiencing serious economic impacts from Defense contractor reductions or base closures.

-- DoL Economic Planning Assistance: Worker placement/retraining assistance is available through DoL (JTPA) grants.
-- DoC Economic Planning Assistance: Economic development project grants are available through DoC (Economic Development Administration) Title IX program, using DoD $80 million.
-- Other Federal Agency Economic Planning Assistance: Technical and financial assistance from members of the President's Economic Adjustment Committee (principally DoL, DoC, SBA) is available by grant or loan tailored to specific community economic adjustment requirements.

Mr. Visclosky. You have individual A in the military and individual B in the military. A participates in a program; B does not. How is that determination made? From what you are telling me, everyone is not going to be part of the mix, for a variety of reasons.

Mr. Deutch. These are not programs which are implemented centrally; they are decentrally administered. I will get back to you for the record on how individuals are selected for these programs.

[Clerk's note.—The information is printed on pages 498–505.]

TEACHING, LAW ENFORCEMENT, HEALTH CARE

Mr. VISCLOSKY. It is also indicated that some of the careers that people are looking to transition into are teaching, law enforcement and health care. Over and above formal military training is the military going to undertake these training programs as a separation aspect?

Mr. DEUTCH. I believe we are looking at new programs directed towards a national goal for the armed services where separated individuals who are seeking a career in health, law enforcement, teaching—and those are the three categories—would be given assistance. Particular programs would be directed towards them.

Mr. VISCLOSKY. I just can't emphasize enough the importance of not doing to these people what was done to those people in northwest Indiana.

Thank you, Mr. Chairman.

Mr. DICKS. Mr. Skeen.

DUAL USE TECHNOLOGY

Mr. SKEEN. Thank you, Mr. Chairman. It is a very interesting discussion we have had today. I represent a State and a district that has probably as good an example of dual-use technology with two national laboratories, Los Alamos and Sandia, and the test facility at White Sands. They have been doing a lot of dual-technology development.

One of the big problems is technology transfer and also, how do you get the private sector convinced that they can use the facilities that we have? What programs do you have in mind for doing that?

Mr. DEUTCH. Mr. Skeen, we do have many programs with the national laboratories, in particular those which involve the weapons programs at Livermore, Sandia and Los Alamos.

I had the opportunity to testify yesterday before the House Armed Services Committee with the directors of those laboratories about the same matters that we are discussing today. In my judgment, a lot of the leadership for the successful transfer to industry has to occur through initiatives at the laboratories. Sandia probably is a good example. Coming from MIT, I am very conscious of competition; it has to do with whether there is a motivation in the laboratory to devote efforts to transfering the technology they generate mainly for defense purposes to the commercial sector.

I believe there is growing interest in the private sector in cooperating with national laboratories, universities and the government; and that is a very important part of the dual-use technology programs we are proposing today.

Mr. SKEEN. I think the laboratories serve as a model, because they have been doing some of this with the private sector to start with. Now the emphasis is much more on private sector technology development than for defense, because of the downsizing, because of lack of threat.

We are curious because this is all you hear in our part of the country, dual technologies, all the pseudonyms that we give this process of agony we are going through.

I appreciate your work. I think we have a good model going, and I hope we can expand it.

Mr. Deutch. Thank you, sir.

Mr. Dicks. Thank you, Mr. Skeen.

Congressman Darden.

FUNDING ISSUES

Mr. Darden. Thank you very much, Mr. Chairman.

Mr. Deutch, thank you for being here. We appreciate your willingness to take on a very difficult program, defense conversion.

Last year this committee appropriated $1.7 billion, and your request for the coming fiscal year is $3.4 billion, about twice that. I read your statement and I am not clear how much of this money has been already obligated or expended out of the $1.7 billion appropriated last year?

Mr. Deutch. I will get you a precise answer for the record about how much money has been obligated of the amount appropriated. I want to say that part of that is because there has been a change of administration. In some of these key programs, the previous administration was not eager to have the funds obligated.

It is our policy to obligate these funds as quickly as is possible in a managerially responsible fashion, so we are not throwing the money out the door; but we are working very hard to obligate the funds that have been voted by Congress and signed into law.

From my managerial background, I would say we are running behind on obligations versus the amount appropriated to us.

Mr. Darden. I think you have also answered my next question, in that do you intend, then—apparently you do—to obligate and expend those funds aggressively that we have provided in the previous Congress? Is that correct?

Mr. Deutch. That is correct, Mr. Darden.

Mr. Darden. Looking through some of the list, I notice there are a number of earmarks as well. Do you anticipate coming back to us with some type of reprogramming or any type of direction from us, or do you believe that you have sufficient latitude now to carry out what you intend to do with the funds?

Mr. Deutch. I don't want to make an absolutely blanket statement, but it is the Secretary's intention to proceed with the projects that have been included in the appropriations bill, as is always the case. There may be one or two, but we would certainly consult with you.

It is our absolute intention to do all of these, although I am not quite sure of the breadth of your question.

Mr. Darden. Do you feel you have sufficient authority within your charge to carry out an aggressive conversion program without having to come back and get additional authority to reprogram any funds?

Mr. Deutch. Yes, sir.

INCENTIVES TO CONVERT

Mr. Darden. During the past 25 years at the Lockheed plant in Marietta, Georgia we have had one layoff or reduction in force, that took place 15 years ago, when the work force was drawn down from 32,000 to less than 10,000 at the end of the C-5A program; and at the end of the C-5B program seven or eight years ago, we reduced the work force there by 10,000 workers. I don't want to sound like a Republican or anything like that when I make this point, but we were able, with minimal assistance, to absorb these workers into the economy; and part of it was because the community recognized a sense of need and urgency, and self-help was a big factor, and a number of private groups—the Chamber, local churches and others—got involved in the effort. Frankly, we were disappointed at the lack of Federal aid available, but we made it, got by and turned the corner.

I am suggesting that as you go about this conversion program that there be incentives and rewards for initiative and that we not create a dependent-type community that leans too much on government assistance and that we not take away the individual incentives. I am not sure how you balance that out, but somehow the word gets out that there is big money available, and the Federal Government is coming, and we are here to help you and so forth; and it is an opportunity to falsely make people believe that the government is going to take care of them. And we can't do that.

Two, we need to use these funds—and I am not sure how, and with your management expertise perhaps you can do this—but we need to put incentives in such a way that rewards people who receive minimal assistance and help themselves rather, than people who tend to rely too much on what the government, through a defense conversion program, might do.

Mr. DEUTCH. I believe that cost-sharing is the best way to assure that we are preserving and encouraging incentives by the firms who wish to participate in the technology partnerships. In the case of communities, we find that communities who are forthcoming and interested and work hard will do better with getting the assistance money that is available. They have overcome what is a very difficult economic effect on their people and their towns.

So I share your view. There is no question about it, that we cannot dollar-for-dollar replace the effects on the economy of a downturn in defense in the near term. In the long term, we hope these assets get redeployed by the private sector in a way which leads to more growth and more prosperity for our people. No question, it is a hard deal while it is going on.

CONTRACTING WITH LOCAL FIRMS

Mr. DARDEN. One other point having to do with the expenditure of funds and the method by which they are expended: I want to encourage you, wherever possible, rather than bringing a large number of government and DOD employees and staffing up the Federal Government workers, that, whenever necessary, you contract with local companies and existing companies and make them aware of opportunities. And perhaps we could have some small entrepreneurial companies spring forth as a result of the availability of funds here, rather than sending a large number of FTE's out to work on a program which would have large administrative costs.

I hope you will look toward trying to contract out a good bit of the money that you will be spending in these communities with local folks.

Mr. DEUTCH. It is both my own experience and the policy of both Dr. Perry, the Deputy Secretary, and myself to rely as much as possible on the private sector and private laboratories for the execution of these and other technology programs. We are headed in that direction.

You also give me the opportunity to mention that we are encouraging our Small Business Innovative Research program, which is as successful in DOD as it is anywhere, to devote part of its efforts to the dual-use technology effort.

Mr. DARDEN. Thank you very much, Mr. Chairman.

Mr. DICKS. Mr. McDade.

PHILADELPHIA NAVAL SHIPYARD

Mr. MCDADE. Thank you, Mr. Chairman.

John, welcome back. It is a pleasure to see you again, with a lot of fond memories on your previous incarnation in Washington. You are a great American to come back for a second trip, particularly at this particular time.

Mr. DEUTCH. It is a pleasure seeing you again, and I look forward to a lot of good times together.

Mr. DICKS. Are you going to discuss coal programs?

Mr. MCDADE. We are going to discuss the future of the world. My good friend, Congressman Foglietta, is here for a specific reason. Let me get into that. Last year Congress appropriated $50 million to implement conversion of the Philadelphia Naval Shipyard, as you know a yard that is drawing down.

Can you tell us the status of that $50 million? What is the status of the program there now?

Mr. DEUTCH. We are putting together a plan with Philadelphia about how this money will be spent. I don't think that a final plan is yet in place, but it is our intention to go through with that program.

In response to a remark you made earlier, Mr. Darden, this is a program we will be implementing.

Mr. MCDADE. Any idea when the money will go out, either by grant or contract or whatever?

Mr. DEUTCH. We will obligate it this fiscal year, sir.

Mr. MCDADE. What is the DOD currently asking the local community to be able to effectively do to use the money before they expire? What is your request to the local community?

Mr. DEUTCH. I believe in all cases we will insist on having a plan before us, a prescribed way that the community intends to work with us.

Mr. MCDADE. A business plan, so to speak?

Mr. DEUTCH. Yes, sir.

Mr. MCDADE. Is that the extent of it, just the general operational plan?

Mr. DEUTCH. Yes, sir.

Mr. MCDADE. Is there funding in fiscal year 1994 to carry on this initiative?

Mr. DEUTCH. I believe we are asking for $30 million, sir, for the Office of Economic Adjustment to assist communities.

Mr. McDade. How much of that would represent the Navy Yard in Philadelphia?

Mr. Deutch. That is $50 million, all in 1993. No money is requested in 1994. We believe we should see how the $50 million goes.

Mr. McDade. Do you have any requirements for any legislative authority to use these dollars? Can you implement what you believe will be a strong effort to try to convert the yard, or do you need any other kinds of legislative activities?

Mr. Deutch. I believe that we are in good shape to proceed with this program. If there is a problem, we will come back and tell you whatever legislative relief we need. Right now, we are in good shape.

Mr. McDade. I would like to hear if you need additional kinds of assistance. We would like to know exactly what it is.

Thank you, Mr. Chairman.

Mr. Dicks. Mr. Hefner.

Mr. Hefner. No questions.

Mr. Dicks. Mr. Foglietta, did you wish to ask a question? As a new Member of the full Appropriations Committee, we will extend you a reasonable period of time.

Mr. Foglietta. Thank you, Mr. Chairman.

Mr. Dicks. We are very honored to have you in the Defense Subcommittee. We know of your long experience on the House Armed Services Committee and of your expertise in these matters. We are delighted to have you here today.

Mr. Foglietta. Thank you, Mr. Chairman. I thank the Ranking Member, my good friend, Mr. McDade, for asking questions.

In the Philadelphia Naval Shipyard we have facilities that are unparalleled probably anywhere in the entire United States. We have five dry docks, three of which can handle the largest ships in the world, as well as aircraft carriers. We have a machine shop and a steel shop and a sheet metal shop, and the high-tech shop that developed the Aegis system.

In most defense conversion programs we have talked about taking defense technology and using defense technology for peaceful purposes. What we are trying to accomplish is to be able to take other operations and those nondefense, nonmilitary, nongovernmental operations into the facilities.

We have to use those facilities at the yard, in addition to continuing to do any work that has to be done for the Navy at the Philadelphia Naval Shipyard. Part of what the $50 million will be used for, is to put together a program which will create a revolving loan fund, and to use that fund to attract new businesses to the yard.

This is innovative, and I have spoken to the President's economic group, as well as to the Secretary of Defense and all of them seem enthused about this kind of a program, where we will take all those facilities, as well as a 15,000-person work force, and be able to attract other new businesses into the yard to develop a sort of combined public-private facility for development of jobs in that area.

It just did not seem to make sense to us, when the President is talking about programs that create jobs, to take a facility like this and to eliminate five or six or seven thousand or even ten thousand jobs at the yard and close down a facility, and then try to attract workers to come in with rakes and clean up grass; whereas we can take the facilities and bring people in and create more jobs.

That is what we are attempting to do at the Philadelphia Naval Shipyard, and we would like your help and cooperation.

Mr. DEUTCH. You have the Department's help and cooperation. We will execute a plan.

Mr. FOGLIETTA. Thank you for the opportunity to ask a question and to make a statement, Mr. Chairman.

ASSISTANCE TO INDIVIDUALS

Mr. DICKS. The President's conversion plan provides $375 million in fiscal year 1993 and $4 billion over five years for Federal transition assistance, employment services, and job training. It also offers early retirement benefits after 15 years to military personnel, and funds pilot programs for helping military personnel and defense workers enter careers in teaching, health care and law enforcement.

What is DOD's strategy for military and civilian worker training and adjustment? Congress has spoken rather clearly that we are very concerned about the military and also concerned about our civilian workers who are going to be dislocated because of the downsizing. Can you give us kind of what your strategy is on this?

Mr. DEUTCH. Mr. Chairman, we have two approaches. One is helping those individuals who lose their positions because of the downturn in defense find other productive employment as quickly as possible. We have some assistance programs directly in that line.

We are constructing other programs to help departing National Guard, Reserve, and Army personnel enter community-based professions like health care, law enforcement and teaching. We are also working with the Department of Labor and the Department of Commerce to coordinate a program on personnel assistance.

Our programs are, I think, helpful to people. They, of course, are not substitutes for jobs, and I don't want to pretend that they are. It is difficult when these things happen, and we are trying to work with other agencies to make the transition as effective as possible.

Mr. DICKS. When I was at Fort Lewis a year ago, I was impressed that the Army had established an Army-sponsored program to help the individuals who were going to be mustered out. I thought that was quite good.

Are we doing anything of that nature for civilians?

Mr. DEUTCH. I don't believe we have specific training programs for civilian contractor employees.

Mr. DICKS. I am talking about civilian workers in DOD now, not the contractor employees. It seems to me that the services are doing a lot for their own people.

Mr. DEUTCH. Yes.

Mr. DICKS. Then there is this other group of people, the civilian workers of the DOD. And Congress always has to make sure that they are protected and treated properly. I would suggest that that is one area you may want to look at to see if you couldn't set up the same kind of programs the services are to help their people transition out of the service, for the people who are going to transition out of the DOD but who are civilian employees.

Mr. **Deutch**. That is a good point. The Services are much better organized to do these matters than we are.

NEW INITIATIVES

Mr. **Dicks**. I have always known that the services care about their people. I have always hoped that the DOD cared about their civilian employees. With this new compassionate administration, I know you will be taking a hard look at these issues.

Are you going to have new initiatives besides what Congress has done?

Mr. **Deutch**. A lot of the programs that are reflected here come from fiscal year 1993 dollars that were voted by Congress, no question about that.

Mr. **Dicks**. Congress had recommended the parameters in consultation with the previous administration about what the reinvestment plan for people and for communities, would be.

Are there any new initiatives? Or are you going to, basically, stay with the plan that is being developed?

Mr. **Deutch**. I didn't come here prepared to announce new additions not contained in the 1994 budget. We are thinking about more effective programs, not larger programs for community assistance. And we are also interested in programs which would effectively help impacted individuals find jobs.

Mr. **Dicks**. Over the years, the Pentagon's Office of Economic Adjustment and the Commerce Department's Economic Development Administration have been involved in helping communities.

Until recently, OEA and EDA grants were limited to helping communities plan their response to closing bases or major defense plans. Both agencies now use these funds to help communities implement redevelopment plans as well.

COMMUNITY ASSISTANCE

What is DOD's strategy for community assistance?

Mr. **Deutch**. Could I ask Mr. Dempsey, who is the head of that office, to address that?

Mr. **Dempsey**. Be happy to. We are dovetailing our new authority to implement or carry out plans very closely with the initiatives of the Economic Development Administration. We are planning to continue to support communities in the planning phase—the organizing and planning phase of the community adjustment process and then carry that community organization through the transition to implementation where it would be handed off to the Economic Development Administration to support, financially, the carrying out of the various activities articulated in the Community Adjustment Plan.

Mr. **Dicks**. Is this going to have an impact on the OEA's mission and its budget?

Mr. **Dempsey**. Yes. Our budget has tripled since last fiscal year, and the additional resources——

Mr. **Dicks**. What are those numbers?

Mr. Dempsey. It has gone from just about $8 million to $29 million.

Mr. Dicks. Is that enough to do the job?

Mr. Dempsey. Yes, to support organizing and planning in every community that is significantly impacted and to facilitate their transitioning to the implementation of those plans.

Mr. Dicks. Describe what the role of the communities is and what the role of the Federal Government is.

Mr. Dempsey. It is a community-based program. The community organizations such as was the case in Marietta, Georgia, in the 1970s is charged with the responsibility for coming up with an adjustment strategy or, in the case of a closure, a base reuse plan.

The DOD role is to help underwrite the cost for that community organization preparing that reuse plan.

Mr. Dicks. Okay.

Mr. Young?

COMMUNITY COLLEGES

Mr. Young. Mr. Chairman, I would like to ask the Secretary if they are giving any thought or doing any planning to working with the tremendous wealth of talent in our community colleges throughout this country.

As we talk about retraining folks for police or teaching or other skills, it looks to me like we have a real wealth of talent there already in place, with little additional costs to rev them up.

Are you thinking of using them?

Mr. Deutch. Well, I am going to rely on my personal experience. I have recently come back from Massachusetts. Community colleges there are central to execution of retraining programs, and they work closely with local industry.

I believe that some of the National Guard programs currently rely on neighboring community colleges and local institutions to provide the kind of educational environment for retraining.

I don't think we have a specific program targeted on community colleges. But you are right, it is a good point. Community colleges are in the best position to help these people gain the skills to enter the job market productively.

NATIONAL GUARD

Mr. Young. You mentioned the National Guard. In one of our community colleges in my State we have an excellent program to train police officers and other individuals in the field of drug abuse. And it is a program that this Committee had pretty much sponsored and is just getting off the ground. It looks like it is going to be very promising and cost effective.

I have additional questions, but I will submit them to you in writing.

Thank you, Mr. Chairman.

[Clerk's note.—Questions submitted by Mr. Young and the answers thereto follow:]

LAW ENFORCEMENT, HEALTH CARE, AND TEACHING

Question. Secretary Deutch, the Department as well as other Agencies of the Federal Government have a monumental task ahead of them in the Defense Conversion area. One area which is of particular interest is the initiative which would train separating military personnel, DoD and DoE civilian employees, and private sector defense workers in three public service professions for which many are particularly suited: law enforcement, health care, and teaching.

In your planning for accomplishing the conversion of skills for these personnel, particularly in the law enforcement and health care areas, I hope you will not overlook the vast resources we have in this country within our community colleges.

The 5,000 community colleges in this nation are particularly suited to the types of career training you are planning. In addition, they are accessible because of their great number, they are economical with tuition far lower than at universities, and they are not in the "dorm business." Most of the people you want to retrain have already had their fill of "dorm life."

In Florida, more than a third of the students enrolled at the 65 community colleges we have are already in some form of career conversion training. While our nine universities are top-notch, particularly in the field of research, our community colleges are the institutions we rely on to teach and train, particularly in law enforcement and health care.

As the Administration formulates its plans, will it give adequate consideration to the community colleges around the country and what they have to offer?

Answer. At this time, we are working primarily to implement the "Troops to Teachers" placement program. We would certainly consider community colleges around the country as training options for law and health care placements. They have excellent training programs for law enforcement and health care.

Question. How much of the program you are proposing will go toward retraining in these three fields?

Answer. At this time, we are only dealing with the teacher certification legislation and will need experience to see how many apply and what their training needs are. This differs greatly from state to state since each has different certification requirements.

Question. Will you be establishing pilot programs to implement your recommendations? If so where will they be located?

Answer. At present we plan to use in-house adult education resources to assist servicemembers. Servicemembers will then need to obtain necessary credentials required by the states for which they wish to work. We are interested in expediting that process of getting servicemembers into the classroom and allowing them to work on certification while teaching with a minimum of training above their bachelors degree.

Question. Will you be consulting with the post-secondary education community and particularly those involved in community colleges as you implement your initiatives in this field?

Answer. Certainly that will be a good option for the health care and law enforcement training needs. The teacher certification, again, needs programs tailored by individual shortfalls for state certification requirements. School systems will need to help facilitate acquiring that certification in a hands-on environment and perhaps in conjunction with local community colleges resources.

Question. Has anyone been appointed to oversee this particular item in the Defense Conversion initiative?

Answer. Yes, this authority has been delegated to the office of Force Management and Personnel along with other personnel-related programs that assist military and civilians with transition to a second career.

TECHNOLOGY TRANSFER

Question. How much of the funds available for defense conversion will be made available for technology transfer initiatives, especially at government owned facilities in which our nation has made a substantial investment over the years?

Answer. The amount of Technology Reinvestment Program (TRP) funding that will be designated for technology transfer initiatives at government owned facilities cannot be quantified before the successful projects are selected. The TRP solicitation closes in mid-July. Proposal evaluation will begin immediately after the solicitation closes, and announcement of successful proposals will begin in late FY 1993.

Question. This specifically relates to the defense programs of the Department of Energy, which in most cases owns the production facilities. They are seeing the workload at these facilities being significantly scaled back. If we can develop businesses to have access to the billions of dollars in high tech equipment and resources in these facilities, it becomes much more economical to retain these facilities and their defense production capabilities. Have you taken a look at this specific issue and have you designed a set amount of defense conversion funds for this use?

Answer. There has not been a specific allocation of DoD defense conversion funds for technology transfer programs at the Department of Energy (DOE) laboratories and plants. However, there is an opportunity for DOE and its facilities to accomplish technology transfer of the type you propose through the Technology Reinvestment Project (TRP). TRP programs will develop dual-use technologies, provide manufacturing and technology assistance to small businesses, enhance U.S. manufacturing skills, and assist displaced defense industry workers. Within TRP there is a technology deployment activity intended to assist the private sector with acquiring existing and emerging dual-use and commercial technologies from various sources, including DOE facilities. DOE laboratories and plants are also expected to participate in other TRP activities by providing their unique capabilities and facilities as part of proposing teams.

[Clerk's note.—End of questions submitted by Mr. Young.]

FINANCIAL STATUS

Mr. Dicks. Mr. Secretary, the Committee would like to establish a complete financial status of the Defense Department's conversion initiative for the record.

Please provide the 1993 and 1994 funding for each of the defense conversion programs at the level of detail contained in the fiscal year 1993 appropriations conference report segregated by appropriations account.

[The information follows:]

[In millions of dollars]

	Fiscal year 1993 appropriation	Fiscal year 1994 budget
RDT&E, ARPA:		
0603570E Defense Reinvestment [1]	561.6	324.0
Dual Use Critical Technology Partnership	95.2	105.0
Commercial-Military Integration Partnerships	47.6	35.0
Regional Technology Alliance Assistance Program	95.2	85.0
Agile Manufacturing and Enterprise Integration	28.6	20.0
Advanced Materials Partnerships (Synthesis & Proc)	28.6	24.0
Advanced Manufacturing Tech Partnerships	23.7	30.0
Manufacturing Engineering Education Programs	28.6	20.0
Manufacturing Extension Programs [2]	95.2	(12.0)
Defense Dual Use Assistance Extension Program [2]	95.2	(13.0)
United States–Japan Manufacturing Training	(3)	5.0
Programs Transfers to ARPA	23.7	0
Other initiatives	1,210.1	1,324.9
0602301E Computing Sys & Comm Tech:		
ST–11 Intelligence Systems/Software	38.8	68.8
ST–19 High Performance Computing	134.4	237.9
ST–21/22 Software Engineering	37.4	39.1
ST–10 Stragetic Computing	68.2	
0603745E Microelectronics Manufacturing	94.8	100.0
0603226E Exper. Evaluation of Major Innovative Tech EE–37 Advanced Simulation	43.5	54.0
0602708E Int Command & Control Tech IC–03 High Definition Systems	152.2	57.2
0602712E Materials and Electronics Tech:		
MPT–01 Materials Processing	73.5	81.3
MPT–02/03 Electronics Processing	74.8	79.4
MPT–06 High Temp. Super Conductivity	35.5	37.8
0603739E Electronics Manufacturing Tech:		
MT–02 MIMIC	80.2	80.2
MT–03 IR Focal Plane Array	34.2	41.4
MT–04 Electronc Module Tech	67.3	97.1
MT–08 Manuf Tech Initiatives	0.0	19.2
MT–10 Advanced Lithography	71.3	47.5
0601101E Defense Research Sciences	109.6	79.7
RDT&E, OSD/WHS:		
0601109D United States–Japan Manufacturing Training	9.4	(3)
0602756D DOD Software Technology Initiative		43.3
RDT&E, all Svcs & DefAg: Small Business Innovative Research (SBIR)	85.0	161.0

[1] The fiscal year 1994 program is a nominal display of the latest estimate. Details won't be available until the fiscal year 1993 program is awarded.

[2] Fiscal year 1993 funds support program over a 2-year period.

[3] Funded in PE0601109D in fiscal year 1993.

ORGANIZATIONAL ISSUES

Mr. Dicks. Which OSD organization has oversight responsibilities? And which field activity has execution responsibility for each of these programs?

Put that in the record as well.

[The information follows:]

Program	OSD organization with oversight responsibility	Field activity with execution responsibility
Community Economic Adjustment Assistance the Economic Development Administration.	Office of Economic Adjustment	Economic Development Administration, Department of Commerce.
Temporary health transition assistance	Assistant Secretary of Defense (Health Affairs).	Armed Services.
Department of Defense civilian personnel transition initiatives.	Assistant Secretary of Defense (Personnel and Readiness).	Armed Services.
Defense efforts to relieve shortages of elementary and secondary school teachers and teacher's aides.	Assistant Secretary of Defense (Personnel and Readiness).	Defense Activity for Nontraditional Education.
Environmental education and retraining programs.	Deputy Under Secretary of Defense (Environmental Security).	Not applicable.
Job training and employment and educational opportunities.	Assistant Secretary of Defense (Personnel and Readiness).	Department of Labor.
Service members occupational conversion and training.	Assistant Secretary of Defense (Personnel and Readiness).	Department of Veterans Affairs and Department of Labor.
Active forces transition enhancements (temporary early retirement authority).	Assistant Secretary of Defense (Personnel and Readiness).	Armed Services.
Guard and Reserve transition initiatives	Assistant Secretary of Defense (Reserve Affairs).	Guard and Reserve Organizations.
Job placement assistance and career training.	Assistant Secretary of Defense (Personnel and Readiness).	Vietnam Veterans Leadership Program.
National Guard Civilian Youth Opportunities Pilot Program.	Assistant Secretary of Defense (Reserve Affairs).	National Guard Bureau and state National Guards.
Civilian Community Corps	Assistant Secretary of Defense (Personnel and Readiness).	Commission on National and Community Service.
Other programs of the Commission on National and Community Service.	Assistant Secretary of Defense (Personnel and Readiness).	Commission on National and Community Service.
Philadephia Naval Shipyard economic conversion initiatives.	Office of Economic Adjustment	Not applicable.
Dual Use Critical Technology Partnerships	Advanced Research Projects Agency (APRA).	Defense Technology Conversion Council.
Commercial-Military Integration Partnerships.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Regional Technology Alliances Assistance Program.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Defense Advanced Manufacturing Technology Partnerships.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Manufacturing Extension Programs	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Manufacturing Engineering Education Programs.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Defense Dual Use Assistance Extension Program.	Advanced Research Projects Agency (APRA).	Defense Technology Conversion Council.
Agile Manufacturing and Enterprise Integration.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Advanced Materials Synthesis and Processing.	Advanced Research Projects Agency (ARPA).	Advanced Research Projects Agency (ARPA)
U.S. Japan Management Training	Director of Defense Research and Engineering.	Air Force Office of Scientific Research.

ACQUISITION STRATEGY

Mr. DICKS. The Committee also requests description of the acquisition strategy and method of contractual execution; for example, contract grant, transfer to another agency and key milestones for each program; and then a forecast of the projected year end obligation rate for each, the amount included in the 1994 DOD budget for new conversion initiatives, the corresponding five-year total estimated cost for all DOD conversion programs, and the amount included in the Federal budget other than DOD for any of the programs for which funding is by multiple agency.

Please separately provide the same information for each of the projects in the Appropriations Committee 1994 DOD conference reports.

Mr. Dicks. Are there any further questions?

Mr. Secretary, thank you very much for being here. We appreciate your good answers. There will be additional questions for the record.

The Committee will recess briefly and reconvene for the next hearing.

[Clerk's note.—Questions submitted for the record and the answers thereto follow:]

OVERVIEW OF DEFENSE CONVERSION

Question. Defense conversion programs fall into 3 general categories: assistance to individuals, assistance to communities, and development of new technologies. Congress appropriated $1.7 billion for these activities in fiscal year 1993.

How can DoD measure results from these programs?

Answer. Measuring results will be an important task as DoD implements defense reinvestment programs. Many of these progarms are new endeavors, and it will be important for the Department to establish baselines, measure success, and adjust program implementation based on this evaluation process.

Different programs will have different methods of measuring results. The Department's defense conversion programs are varied, and no one approach to measuring results will be appropriate for all programs.

The Department recognizes that measuring results is frequently a difficult process that requires detailed analyses. Nevertheless, we are committed to ensuring that our programs will be effective, and measuring results is an important component of managing the programs.

Question. Not all of the conversion programs are considered to be acquisition, which is your area of responsibility. In DoD, who is in charge of the overall conversion initiative and its strategy?

Answer. The Deputy Secretary of Defense has asked me to watch over all parts of the defense reinvestment programs. I am working with other Departments and agencies and with the White House National Economic Council to ensure that DoD's efforts are well integrated with those of other agencies.

Question. How much in fiscal year 1994 is included in the Defense budget to continue conversion initiatives?

Answer. DoD's budget for defense reinvestment and conversion programs for FY 1994 is about $2.3 billion.

Question. How much is required annually to sustain it?

Answer. The Department's long term budgets for defense conversion activities are currently under review. Annual funding required for conversion will be determined by numerous factors, including our experience with new programs that we have only begun to implement.

Question. How long will DoD conversion funding be required, and when will it end?

Answer. The purpose of DoD's defense conversion programs is to help the nation adjust to lower levels of defense spending. Defense conversion programs will end when defense reductions are complete and their effects on the nation have been accommodated. Current plans envision defense reductions continuing at least through 1997.

ASSISTANCE TO INDIVIDUALS

Question. The President's conversion plan provides $375 million in fiscal year 1993 and $4 billion over 5 years for Federal transition assistance, employment services, and job training. It also offers early retirement benefits (after 15 years) to military personnel, and funds pilot programs for helping military personnel and defense workers enter careers in teaching, health care, and law enforcement.

Describe the kinds of programs DoD will offer, and how they will work.

Answer. Current DoD policies ensure we retain by grade, skill, and experience the best-qualified individuals and treat those who separate from the Department with the compassion and fairness they deserve. Our programs make maximum use of voluntary separation incentives.

For military personnel, we have implemented the temporary early retirement program for selected active duty members and a package of transition initiatives for selected Reserve Component personnel.

The temporary early retirement authority may be offered by Service Secretaries to selected members based on eligibility criteria such as grade, years of service, and skill. Early retirees will have the same benefits and obligations as members who retire with 20 or more years of service. However, the retired pay of a member who retires early is reduced by 1 percent for each year of service less than 20. Early retirees can gain additional credit for taking jobs in teaching, law enforcement, etc. and have their retired pay recomputed at age 62. This program will complement our other drawdown programs and help us shape the 15- to 20-year segment of the force.

The Reserve Component transition initiatives include special separation pay for those with more than 20 years of service, early qualification for retired pay at age 60 for those with 15 to 20 years of service, separation pay for those with 6 to 15 years of service, post-separation use of commissaries and exchanges, continuation of Montgomery GI Bill educational assistance, and VSI/SSB and temporary early retirement programs for selected full-time Reservists.

We will continue to mitigate the impact of involuntary separations through maximum use of transition benefits, including separation pay and extended medical care. Another benefit is Operation Transition, which prepares servicemembers and their spouses for life after the military.

For civilians, we will also minimize involuntary separations. We continue our hiring restrictions, and to increase voluntary attrition, we refer DoD employee resumes to Federal and other public and private sector employers through the Defense Outplacement Referral Service, DORS. We will also provide an outplacement subsidy to encourage other Federal agencies to hire surplus DoD employees, paying up to $20,000 of an employee's moving costs to a new Federal job at a new location. Our DoD Priority Placement Program remains the backbone of our internal civilian placement efforts.

As for our voluntary civilian separation incentives, we are offering targeted groups of employees a cash incentive of up to $25,000 to resign, retire, or take early retirement. The offering of these incentives may totally avoid the need for involuntary separations at some installations. We have instituted other regulatory and administrative changes to help employees. Employees at closing installations have right of first refusal for jobs with contractors hired to close the facility. Also, employees facing separation by reduction in force may stay on the rolls on annual leave, if by doing so they become eligible for retirement. The Department will also pay the government portion of health insurance premiums for 18 months for employees who are involuntarily separated.

We are helping separating military personnel, DoD civilians, and defense workers prepare for new employment by working with the other Departments to provide employment and retraining services. We have released $75 million to the Department of Labor for retraining and employment services. We have also released an additional $73.5 million to the Department of Veterans Affairs and $1.5 million to the Department of Labor to implement the Service Members Occupational Conversion and Training Act, which will provide training to veterans. In conjunction with the Department of Labor, the Department of Veterans' Affairs, and state employment agencies, DoD has also increased its efforts to provide employment information to separating personnel and to provide transition assistance services to members of National Guard and Reserve units.

To match separating defense workers with public and community service jobs, the Department is developing computer-based registries of defense employees interested in public and community service organizations. We are also developing pilot programs for placing former defense personnel in the teaching field and are considering similar programs for health care and law enforcement.

ASSISTANCE TO COMMUNITIES

Question. The President's conversion plan increases funding for the Pentagon's Office of Economic Adjustment (OEA) and the Commerce Department's Economic Development Administration (EDA).

Both agencies assist communities with economic development and infrastructure planning and financing. Until recently, OEA and EDA grants were limited to helping communities *plan* their responses to closing military bases or major defense plants. Both agencies now use these funds to help communities *implement* redevelopment plans as well.

Describe the results of DoD's Office of Economic Adjustment program prior to the President's initiative.

Answer. A sample survey of 100 communities that closed between 1961 and 1990 shows that:

New jobs (158,000) more than replace the loss of 93,000 former DoD civilian jobs;

A number of four-year colleges and post-secondary vocational technical schools or community colleges have an enrollment of over 73,000 students;

Industrial and office parks are located at more than 75 bases;

Forty-two former DoD facilities are being used as Municipal or General Aviation Airports.

Question. What will be done differently now?

Answer. The approach and process will be the same. However, OEA now will provide financial assistance beyond what is needed for planning. It will support community requirements to transition to the long-term entity that is responsible for acquiring and operating the former DoD property.

OEA also plans to solicit proposals from states to support local community adjustment and business assistance programs. In addition, four pilot projects will be initiated to explore and evaluate alternative methods for approaching economic adjustment.

DEVELOPMENT OF NEW TECHNOLOGIES

Question. The most widely touted part of the President's plan is the funding of dual use technology development and other R&D initiatives conducted by the Advanced Research Projects Agency. Congress provided over $.5 billion for such programs in 1993.

General Dynamics has a policy of divestiture of its assets because it believes conversion is impractical. Discuss the general reaction so far from Defense prime contractors to DOD's program.

Answer. Reaction from large defense contractors that are primarily military suppliers has been mixed. This group may indeed have great difficulty converting to commercial products. The problems range from internal culture to a lack of understanding of the marketplace. However, this decision process must be led by the individual companies. While these large companies sort out their conformation strategies, we believe that we can be successful by placing emphasis on the first, second, or third tier of defense subcontractors. These companies have the culture and structure to make the conversion since many already participate in both military and commercial markets.

Question. Describe the Federal inter-agency mechanism that has been developed to manage these funds.

Answer. Five departments negotiated a Memorandum of Understanding (MOU) to jointly plan and execute these programs. The MOU establishes the Defense Technology Conversion Council (DTCC), led by the DOD/Advanced Research Projects Agency, with participation initially by the Department of Energy/Defense Programs, the Department of Commerce's National Institute of Standards and Technology, the National Science Foundation, and the National Aeronautics and Space Administration. The Department of Transportation has recently joined the group. The effort is also known as the Technology Reinvestment Project (TRP).

Question. How much is budgeted for R&D conversion programs in FY 1994?

Answer. The department is requesting $324.0 million of FY 1994 funding under PE 0603570E for R&D conversion programs.

Question. How will DOD measure success or otherwise determine that investments of this magnitude are actually paying off?

Answer. Success of the Technology Reinvestment Project (TRP) programs will be measured against milestones and completion schedules that are determined when the projects are selected for funding. However, the ultimate measure of success of each of the TRP programs will be the extent that these programs create, mature, and transition technologies into new products and processes.

APPROPRIATIONS MEMBERS' EARMARKS

Question. The Appropriations Committees in their 1993 DOD conference report earmarked funds only for 24 specific projects, which were not otherwise addressed in the Armed Services Committees' conference report.

What is the Department's criterion for funding earmarked projects?

Answer. Title IV Defense Conversion, Reinvestment and Transition Assistance Act funding will be competitively awarded in accordance with the statutory provisions of Public Law 102-484. Ongoing programs that were separately justified in the FY 1993 President's budget and earmarked by the Appropriation Conference Report are being executed as originally budgeted.

Question. Which of the earmarked projects does DoD plan to implement?

Answer. With the exception of those earmarked projects originally included in the FY 1993 President's budget, earmarked programs are expected to compete under the solicitation that closes in July 1993. Those earmarked projects with significant technical merit will be strong candidates for selection. However, it is impossible to prejudge the results of a competitive solicitation and therefore impossible to definitively identify those earmarked projects that will be selected.

Question. Which of the earmarked projects does DoD plan to ignore?

Answer. It is impossible to prejudge the outcome of a competitive solicitation and therefore impossible to definitively identify those earmarked projects that will be rejected.

Question. In the R&D area, DoD apparently interprets the Armed Services' law to override the Appropriations' report language earmarks. Is this Secretary Aspin's interpretation?

Answer. Public Law 102–484 mandates selection criteria that precludes targeting awards to specific projects or organizations on a non-competitive basis. The Department makes every attempt to comply with guidance provided by the Appropriations Conference Report; however, report language does not override statutory direction.

Question. Explain how DoD would propose to use funds for earmarked projects should it reject proposals from the organizations performing the work. Do you plan to spend our money on other projects?

Answer. The Committee will be advised of those earmarked programs that are not competitively selected, and the reapplication of those funds for other Defense Reinvestment programs will be resolved with the Committees. Pending completion of the selection process, it is impossible to determine whether execution of the earmarked programs will be an issue.

PHILADELPHIA NAVAL SHIPYARD

Question. The Congress appropriated $50 million to implement conversion of the Philadelphia Naval Shipyard (PNSY).

Is O&M the correct appropriation for these funds?

Answer. O&M funds cannot be used to fund construction, procurement, or research and development, three categories of activities that Philadelphia's plan probably will contain. Different appropriation categories would be necessary if the funds are to be used to support the range of investments that are likely to be identified in the consensus plan.

FINANCIAL DATA FOR THE RECORD

Question. The Committee would like to establish a complete financial status of the Defense Department's conversion initiative for the record. Please provide:

The 1993 and 1994 funding for each of the defense conversion programs at the level of detail contained in the 1993 Appropriations' conference report, segregated by appropriation account;

The amount included in the 1994 DoD budget for new conversion initiatives?

Answer. The detailed breakdown is as follows:

[In millions of dollars]

	Fiscal year 1993 appropriation	Fiscal year 1994 budget
RDT&E, ARPA:		
9603570E Defense Reinvestment [1]	561.6	324.0
Dual Use Critical Technology Partnerships	95.2	105.0
Commercial-Military Integration Partnerships	47.6	35.0

[In millions of dollars]

	Fiscal year 1993 appropriation	Fiscal year 1994 budget
Regional Technology Alliance Assistance Program	95.2	85.0
Agile Manufacturing and Enterprise Integration	28.6	20.0
Advanced Materials Partnerships (Synthesis & Proc)	28.6	24.0
Advanced Manufacturing Tech Partnerships	23.7	30.0
Manufacturing Engineering Education Programs	28.6	20.0
Manufacturing Extension Programs [2]	95.2	(12.0)
Defense Dual Use Assistance Extension Program [2]	95.2	(13.0)
United States-Japan Manufacturing Training	([3])	5.0
Programs Transfer to ARPA	23.7	0
Other initiatives	1,210.1	1,324.9
0602301E Computing Sys & Comm Tech:		
ST–11 Intelligence Systems/Software	38.8	68.8
ST–19 High Performance Computing	134.4	237.9
ST–21/22 Software Engineer	37.4	39.1
ST–10 Strategic Computing	68.2	
0603745E Microelectronics Manufacturing	94.8	100.0
0603226E Exper. Evaluation of Major Innovative Tech EE–37 Advanced Simulation	43.5	54.0
0602708E Int Command & Control Tech IC–03 High Definition Systems	152.2	57.2
0602712E Materials and Electronics Tech:		
MPT–01 Materials Processing	73.5	81.3
MPT–02/03 Electronics Processing	74.8	79.4
MPT–06 High Temp. Super Conductivity	35.5	37.8
0603739E Electronics Manufacturing Tech:		
MT–02 MIMIC	80.2	80.2
MT–03 IR Focal Plane Array	34.2	41.4
MT–04 Electronic Module Tech	67.3	97.1
MT–08 Manuf Tech Initiatives	0.0	19.2
MT–10 Advanced Lithography	71.3	47.5
0601101E Defense Research Sciences	109.6	79.7
RDT&E, OSD/WHS:		
0601109D United States-Japan Manufacturing Training	9.4	([3])
0602756D DoD Software Technology Initiative		43.3
RDT&E, all Svcs & DefAg. Small Business Innovative Research (SBIR)	85.0	161.0

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[1] The fiscal year 1994 program is a nominal display of the latest estimate. Details won't be available until the fiscal year 1993 program is awarded.

[2] FY 1993 funds support program over a 2-year period.

[3] Funded in PE0601109D in fiscal year 1993.

Question. Which OSD organization has oversight responsibility and which field activity has execution responsibility for each of these programs?

Answer. See the table below.

Program	OSD organization with oversight responsibility	Field activity with execution responsibility
Community Economic Adjustment Assistance the Economic Development Administration.	Office of Economic Adjustment	Economic Development Administration, Department of Commerce.
Temporary health transition assistance	Assistant Secretary of Defense (Health Affairs).	Armed Services.
Department of Defense civilian personnel transition initiatives.	Assistant Secretary of Defense (Personnel and Readiness).	Armed Services.
Defense efforts to relieve shortages of elementary and secondary school teachers and teacher's aides.	Assistant Secretary of Defense (Personnel and Readiness).	Defense Activity for Nontraditional Education.
Environmental education and retraining programs.	Deputy Under Secretary of Defense (Environmental Security).	Not applicable.
Job training and employment and educational opportunities.	Assistant Secretary of Defense (Personnel and Readiness).	Department of Labor.

Program	OSD organization with oversight responsibility	Field activity with execution responsibility
Service members occupational conversion and training.	Assistant Secretary of Defense (Personnel and Readiness).	Department of Veterans Affairs and Department of Labor.
Active forces transition enhancements (temporary early retirement authority).	Assistant Secretary of Defense (Personnel and Readiness).	Armed Services.
Guard and Reserve transition initiatives	Assistant Secretary of Defense (Reserve Affairs).	Guard and Reserve Organizations.
Job placement assistance and career training.	Assistant Secretary of Defense (Personnel and Readiness).	Vietnam Veterans Leadership Program.
National Guard Civilian Youth Opportunities Pilot Program.	Assistant Secretary of Defense (Reserve Affairs).	National Guard Bureau and state National Guards.
Civilian Community Corps	Assistant Secretary of Defense (Personnel and Readiness).	Commission on National Community Service.
Other programs of the Commission on National and Community Service.	Assistant Secretary of Defense (Personnel and Readiness).	Commission on National and Community Service.
Philadelphia Naval Shipyard economic conversion initiatives.	Office of Economic Adjustment	Not applicable.
Dual Use Critical Technology Partnerships...	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Commercial-Military Integration Partnerships.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Regional Technology Alliances Assistance Program.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Defense Advanced Manufacturing Technology Partnerships.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Manufacturing Extension Programs	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Manufacturing Engineering Education Programs.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Defense Dual Use Assistance Extension Program.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Agile Manufacturing and Enterprise Integration.	Advanced Research Projects Agency (ARPA).	Defense Technology Conversion Council.
Advanced Materials Synthesis and Processing.	Advanced Research Projects Agency (ARPA).	Advanced Research Projects Agency (ARPA).
U.S. Japan Management Training	Director of Defense Research and Engineering.	Air Force Office of Scientific Research.

Question. Please provide a description of the acquisition strategy, method of contractual execution (e.g., contract/grant/transfer-to-another agency), and key milestones for each of these programs.

Answer. Projects that are selected for funding by Technology Reinvestment Project (TRP) solicitation will not utilize the standard procurement contract. The legislation specifically indicates that the two education-related programs will be funded by grants. The Advanced Research Projects Agency (ARPA) plans to use "other transactions" whenever possible. Other members of the six-agency Defense Technology Conversion Council (DTCC) who serve as agents for funding TRP projects will select the most appropriate authority delegated to their respective agencies. Our goal is to identify initial projects for funding before the end of the fiscal year.

Question. Please provide a forecast of the projected year end obligation rate for each defense conversion program.

Answer. The FY 1993 Defense Conversion program is being executed by the Advanced Research Projects Agency (ARPA) through the Technology Reinvestment Project (TRP). The solicitation for TRP proposals was released on May 14, 1993 with proposals due on July 23, 1993. Until the proposals have been reviewed, estimated obligation dates cannot be projected. Selections will be made during the final quarter of FY 1993.

Question. Please provide the corresponding 5 year total estimated cost for all of the DoD conversion programs; and the same information for each of the projects earmarked in the Appropriations committee's 1993 DoD conference report.

Answer. The FY 1994 Future Year Defense Plan (FYDP) does not identify funds at the project/program level because of the need to conduct a thorough bottom-up review of the Defense program. Five year projections for the Defense Conversion programs will be submitted with the FY 1995 budget submission.

Question. The committee would like to establish a complete financial status of the Defense Department's conversion initiative for the record. Please provide the amount included in the Federal Budget (other than DOD) for any of the programs for which funding is by multiple agency.

Answer. The Director of Defense Research and Engineering is not aware of any funding in the Federal Budget which has been designated for use on multiple agency programs.

[CLERK'S NOTE.—End of questions submitted for the record.]

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